Engineering & Science

Sampling and Analysis Plan/ Quality Assurance Project Plan
Wellman Dynamics Corporation
Creston, Iowa
USEPA ID No. IAD065218737
Revision 2

October 2006

Prepared For:

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TITLE/SIGNATURE PAGE

Sampling and Analysis Plan/
Quality Assurance Project Plan
RCRA Facility Investigation
Wellman Dynamics Corporation
Creston, Iowa
USEPA ID No. IAD065218737

April 2006

Prepared by: BT^2, Inc.

Prepared for: Wellman Dynamics Corporation

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Joe Haller, Wellman Dynamics Corporation Facility Project Coordinator	Date
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Stephen Sellwood	4-24-06
Stephen Sellwood, BT^2, Inc. Technical Coordinator	Date
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Tom Culp, BT^2, Inc. QA Officer	Date
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Patricia Murrow, USEPA Project Manager	Date
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Diane Harris, USEPA Regional Quality Assurance Manager	Date

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TABLE OF CONTENTS

TABLE OF CONTENTS (CONTINUED)

TABLE OF CONTENTS (CONTINUED)

TABLES

FIGURES

APPENDICES

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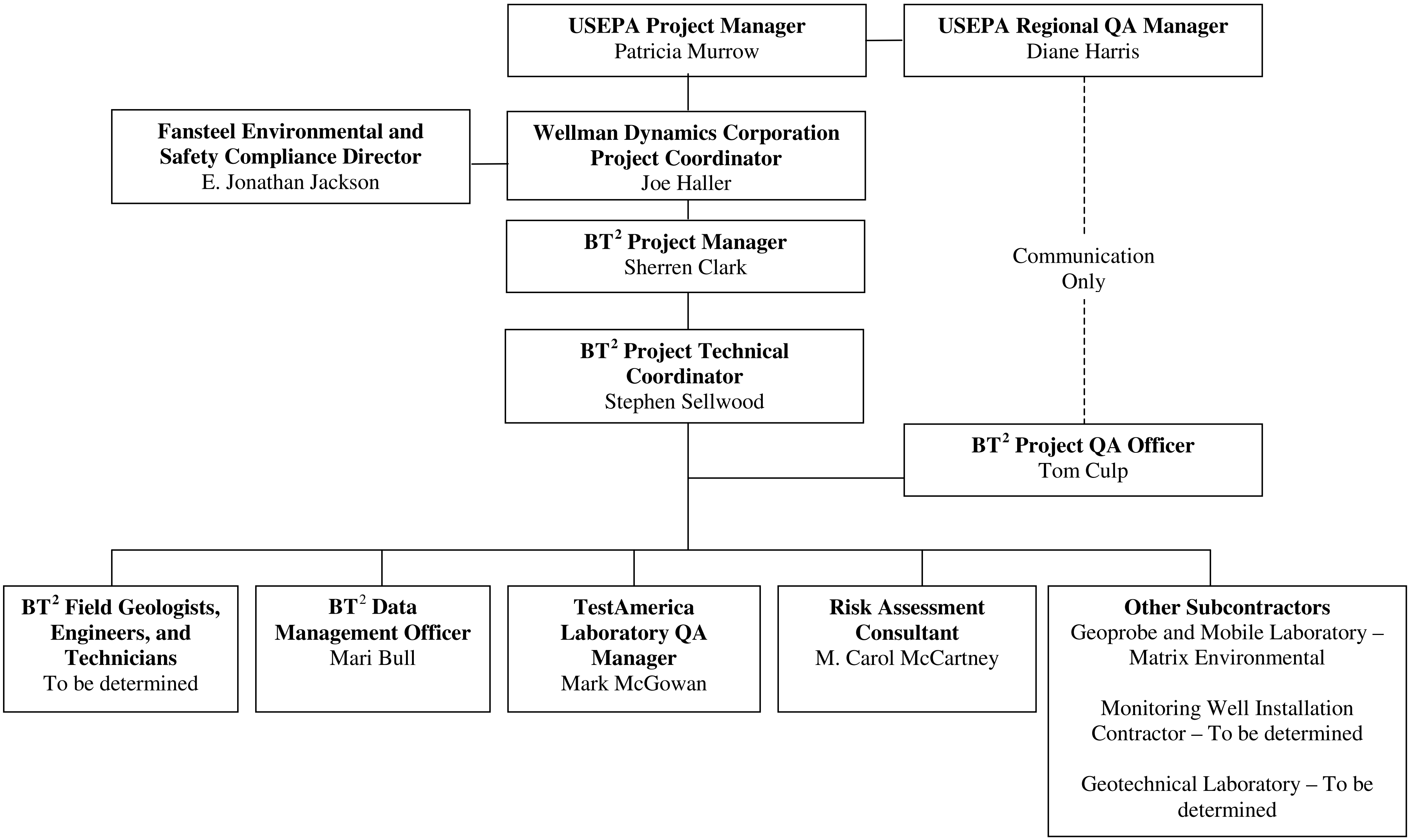
PROJECT ORGANIZATIONAL CHART
RCRA Facility Investigation Workplan
Wellman Dynamics Corporation, Creston, Iowa



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GROUP A: PROJECT MANAGEMENT

The purpose of this document is to describe the personnel, procedures, and methods for assuring the quality, accuracy, and precision of data associated with the Remedial Facility Investigation (RFI) of the Wellman Dynamics Corporation (WDC) facility in Creston, Iowa. Adhering to the procedures detailed in this Sampling and Analysis Plan/Quality Assurance and Project Plan (SAP/QAPP) will ensure that the collected data meet the decision-making needs of the project. This SAP/QAPP is organized to follow the order of the required QAPP elements in the USEPA's *Guidance for Quality Assurance Project Plans, EPA/QA/G-5*. The SAP/QAPP was also prepared in accordance with the requirements of the Administrative Order on Consent (Order) issued by the United States Environmental Protection Agency (USEPA) that became effective on January 23, 2004. A copy of the Order is provided in the Project Management Plan that accompanies this SAP/QAPP.

A.1 Title and Approval Sheet

The Title and Approval Sheet is page ii of this document. Revision 1 of the SAP/QAPP was approved with modifications in a letter from USEPA dated September 25, 2006. This document (Revision 2) incorporates the requested modifications.

A.2 Table of Contents and Document Control Format

The Table of Contents begins on page iii of this document. The document version and date are provided in the header at the top of each page.

This SAP/QAPP is one of six documents that comprise the WDC RFI Workplan. The other five Workplan component documents include:

- Project Management Plan
- Data Management Plan
- Health and Safety Plan
- Community Relations Plan
- Risk Assessment Workplan

These component documents reference each other and should be reviewed in combination to obtain a complete understanding of the proposed RFI.

A.3 Distribution List

SAP/QAPP Distribution List	Telephone Number
Patricia Murrow, USEPA Project Manager	(913) 551-7627
Diane Harris, USEPA Regional Quality Assurance Manager	
Joe Haller, Wellman Dynamics Corporation Project Coordinator	(641) 782-8521, ext. 206
E. Jonathan Jackson, Fansteel Environmental and Safety Compliance Director	(847) 689-4900, ext. 553
Sherren Clark, BT^2 Project Manager	(608) 216-7323
Tom Culp, BT^2 QA Officer	(608) 216-7340
Stephen Sellwood, BT^2 Project Technical Coordinator	(608) 216-7345

A.4 Project/Task Organization

A project organization chart is provided on page vi of this document, immediately following the Table of Contents. The individuals participating in the WDC project and their specific roles and responsibilities are outlined below:

Patricia Murrow, USEPA Project Manager – The USEPA Project Manager is the primary decision maker for the project and the primary data user. Responsibilities include:

1. Overall coordination of the project.
2. Review and approve the SAP/QAPP and subsequent revisions in terms of project scope and objectives.
3. Provide technical consultation.
4. Review progress reports.
5. Ensure SAP/QAPP implementation.

Diane Harris, USEPA Quality Assurance Manager – Responsibilities include:

1. Final review and approval of the SAP/QAPP and subsequent revisions.
2. Provide Quality Assurance (QA) technical assistance to the USEPA Project Manager.

Joe Haller, Wellman Dynamics Corporation Project Coordinator – Mr. Haller is the designated WDC Project Coordinator. Responsibilities include:

1. Review and approval of the SAP/QAPP and subsequent revisions.
2. Provide primary point of contact with USEPA Project Manager.

E. Jonathon Jackson, Fansteel Environmental and Safety Compliance Director – Responsibilities include:

1. Assist WDC Project Coordinator with review of the SAP/QAPP.

Sherren Clark, BT^2 Project Manager – Ms. Clark's responsibilities are:

1. Develop the SAP/QAPP.
2. Coordinate field and laboratory activities.
3. Conduct project activities in accordance with the SAP/QAPP.
4. Evaluate data usability.
5. Prepare progress reports to the USEPA Project Manager.

Tom Culp, BT^2 QA Officer – The BT^2 QA Officer is not involved with data generation activities. Mr. Culp's s responsibilities are:

1. Review and approve the SAP/QAPP.
2. Provide QA technical assistance to the BT^2 Project Manager.
3. Conduct internal QA audits.
4. Report results of internal QA audits to the BT^2 Project Manager.
5. Validate field and laboratory data.

Stephen Sellwood, BT^2 Project Technical Coordinator – Mr. Sellwood's responsibilities are:

1. Direct the sampling operations in accordance with the SAP/QAPP.
2. Distribute the approved SAP/QAPP and subsequent revisions to the members of the field sampling team.
3. Report problems in the field to the BT^2 Project Manager.
4. Review and verify field data.

Mark McGowan, TestAmerica QA Officer – The responsibilities of the laboratory QA Officer include:

1. Manage laboratory QA program.
2. Review and verify laboratory data.

A.5 Problem Definition/Background

A complete description of the site history, operations, and environmental conditions at the facility can be found in the Final Current Conditions Report (CCR) (BT^2, 2005). The CCR was prepared with the objective of streamlining the RFI process by consolidating the previously acquired site data from various sources. This information has been be used to focus the scope of the RFI. The following discussion provides a brief summary of the site background and environmental issues.

A.5.1 Facility Description and History

WDC is located at the northwest corner of the intersection of U.S. Highway 34 and Osage Street in the Creston Industrial Park in Union County, Iowa. The facility is located just outside of the City of Creston (City) corporate limits in the Township of Highland, but is served by City water and sewer. The WDC property includes an area of approximately 42 acres. The site location is shown on **Figure 1**. The site layout and features are shown on **Figure 2**.

The facility was originally constructed in 1965 as an aluminum and magnesium foundry and has been used for the same purpose since that time. The facility was initially owned by Hills McCanna Corporation of Chicago, Illinois, and then was operated by a variety of owners from 1971 to 1985. In 1985, Beatrice Corporation sold the facility to Fansteel, Inc. WDC is a wholly owned subsidiary of Fansteel, Inc.

WDC manufactures magnesium and aluminum alloy castings primarily for the aerospace industry. Products include complex components for helicopters, missiles, rocket engines, jet engines, and structural parts for both military and commercial aircraft, such as the Bell/Boeing V-22 Tilt Rotor, the Rolls Royce/BMW BR710 jet engine, and the Pratt and Whitney alternate turbopump for the Space Shuttle main engines. Non-aerospace applications have included 1,600-pound magnesium transfer pumps for the oilfield industry and porosity-free castings for computer chip manufacturing. Various magnesium and aluminum alloys are cast to achieve specific final properties.

The facility includes two main buildings and several smaller outbuildings. The main production building is approximately 285,000 square feet in area, and houses the administrative offices, foundry, and supporting operations. The second major building is the pattern storage and warehouse building, located north of the main production building. Outbuildings include several storage sheds, the effluent sewer shed, and the guard shack.

Foundry operations are conducted in the main production building. Foundry operations include melting the solid metal, pouring the liquid metal into a mold, and allowing the metal to solidify. The solidified metal part, known as a casting, goes through several cleaning, inspection, and testing steps prior to shipping to the customer.

A.5.2 Environmental Issues and RFI Areas of Investigation

The CCR describes in detail the known contaminants in soil and groundwater at the WDC facility and the areas in which the contaminants are found. The RFI will focus on investigating the degree and extent of contamination at the facility and evaluating the risk posed to human health and the environment by site contaminants.

The RCRA Facility Assessment (RFA) performed by a USEPA contractor in 1993 identified 12 solid waste management units (SWMUs) at the WDC facility. The CCR includes a preliminary evaluation of the current status and the need for further action at the 12 SWMUs plus two additional areas of concern (AOCs) identified since the RFA was performed. Of the 12 SWMUs, nine are proposed to be included in the RFI. The SWMUs and AOCs are summarized in **Table 1**. The locations of the SWMUs and AOCs are shown on **Figure 2**. Potential exposure pathways are summarized on **Figure 3**.

A.5.3 RFI Objectives

The objectives of the RFI are:

1) To determine the nature and extent of any release of hazardous wastes and/or hazardous constituents at or from the facility
2) To determine whether environmental contamination related to any releases poses an unacceptable risk to human health or the environment
3) To gather data to support a Corrective Measures Study, if required

A.6 Project/Task Description

The RFI will include the investigations necessary to:

- Characterize the facility
- Define the source(s) of contamination
- Define the degree and extent of contamination
- Identify actual or potential receptors
- Support completion of a risk assessment
- Support development and evaluation of corrective measure alternatives, if required

The RFI will focus on filling data gaps identified in the CCR. The new site investigation data will supplement the previously generated data.

The following discussion provides a general outline of the types of field measurements and sampling to be completed during the RFI. Primary equipment to be used in the RFI will include:

- Direct-push soil/groundwater sampling equipment (Geoprobe™ or equivalent)
- Hollow-stem auger drilling rig
- Surface soil and sediment sampling equipment (trowels, shovels, bowls)
- Groundwater and surface sampling equipment (pumps, bailers, dippers)
- Groundwater field monitoring equipment (pH, conductivity, temperature, turbidity, dissolved oxygen, oxidation-reduction potential, temperature)
- Photo-ionization detector (PID)
- Water level monitoring equipment
- Slug testing equipment
- Mobile laboratory for VOC analysis
- Survey equipment

More specific information is provided in **Section B.1**. Sampling personnel will be trained in accordance with OSHA requirements as described in **Section A.9**.

A.6.1 Environmental Setting

The RFI will characterize the environmental setting of the WDC facility, including the site hydrogeology, geology, hydrology, and climate. In addition to existing data for the facility, field measurement and sampling tasks to support the environmental setting characterization will include:

- Geologic logging of borings advanced for contaminant characterization tasks
- Water level measurements at existing and new monitoring wells
- Sampling major soil type(s) for physical/chemical laboratory analysis (e.g., hydraulic conductivity, bulk density, sorptive capacity, cation exchange capacity, organic content, pH, grain size distribution)

Climate data will be obtained from the National Climatic Data Center or other appropriate sources.

A.6.2 Source Characterization

The RFI will characterize the potential source areas (SWMUs, AOCs), including the type, quantity, physical form, disposition, and facility characteristics affecting a potential release. The potential source characterization has been largely completed through the RFA and CCR process. However, limited additional sampling tasks will be performed as needed to support this characterization, including:

- Sampling waste materials for physical/chemical laboratory analysis

A.6.3 Contamination Characterization

The RFI will characterize the extent, origin, direction, and rate of movement of contaminant plumes on site and off site. The RFI will address groundwater, soil, surface water, and sediment contamination, as well as any immiscible phase originating from the facility.

In addition to existing data for the facility, field measurement and sampling tasks to support the contamination characterization will include:

- Collecting and analyzing surface water samples
- Collecting and analyzing sediment samples
- Collecting and analyzing surface soil samples
- Collecting and analyzing subsurface soil samples from direct-push or drilled soil borings
- Installing monitoring wells
- Collecting and analyzing groundwater samples from monitoring wells (existing or new)
- Collecting and analyzing groundwater samples from temporary wells in direct-push soil borings

The quality of previously collected data for use in the RFI will also be assessed.

A.6.4 Receptor Characterization and Risk Assessment Support

The RFI will characterize the human populations and environmental systems that may be susceptible to contaminant exposure from the facility, including groundwater use, surface water use, land use, surface water biota, ecology, and endangered or threatened species. Field investigations for these characterizations will be limited to field observations by knowledgeable persons to supplement information available from public sources. The receptor characterization will be documented in the risk assessment.

A.6.5 Corrective Measures Alternatives Support

The RFI data will be used to support evaluation of corrective measures alternatives if corrective measures are determined to be necessary. In general, the data collected to characterize the environmental setting, contaminant sources, extent of contamination, and receptors will be used to evaluate corrective measures, if needed. If additional data needs are identified, they will be outlined in the Corrective Measures Study Work Plan.

A.6.6 Applicable Technical, Regulatory, or Program-Specific Standards, Criteria, or Objectives

The RFI will identify potentially applicable standards and support the selection of Preliminary Remediation Goals appropriate to the facility. Applicable standards may include the following:

- Groundwater
  - Maximum Contaminant Levels established by USEPA
  - Background levels determined based on site-specific and/or regional data
  - USEPA Preliminary Remediation Goals (PRGs) and Risk-Based Concentrations (RBCs)
  - EPA-approved Alternate Concentration Limits
  - Site-specific PRGs developed as described in the Risk Assessment Work Plan
- Soil
  - Soil Screening Levels (SSLs) calculated following USEPA Soil Screening Guidance
  - Ecological Soil Screening Levels (Eco-SSLs) developed in accordance with USEPA Guidance
  - Background levels determined based on site-specific and/or regional data
  - Site-specific PRGs developed as described in the Risk Assessment Work Plan
- Air
  - National Ambient Air Quality Standards

Site-specific background concentrations for groundwater will be determined based on results from upgradient monitoring well nest MW6/MW7/MW8. Site-specific background concentrations for soil will be evaluated as needed for parameters where background concentrations may exceed risk-based screening levels or contribute significantly to site concentrations above risk-based screening levels. The approach for site-specific background soil sampling is outlined in **Section B.1.8**.

A.6.7 Proposed Schedule

To maximize the efficiency of the RFI, a phased approach is proposed. For some areas of investigation, the proposed RFI work scope described in **Section B.1** includes multiple steps, with "if-then" statements outlining the conditions under which the additional work will be done. As the field activities outlined in this SAP/QAPP are performed, the data will be evaluated to determine if it is adequate to meet the RFI objectives. If additional data are needed beyond the investigation steps described in this document, a SAP/QAPP addendum will be submitted and additional data will be collected prior to completion.

The proposed project schedule is shown on **Figure 4**. The schedule is based on final approval of the RFI Workplan by March 15, 2006. If final workplan approval is granted later than this date, then the schedule will be adjusted accordingly.

The schedule includes all of the specifically proposed initial investigation work as outlined in **Section B.1**. If additional work is required, such as additional soil borings, then the schedule may need to be modified. However, the proposed schedule includes time between the first and second rounds of groundwater sampling (planned to coincide with the semiannual landfill sampling) when additional investigation tasks could potentially be completed without affecting the ultimate RFI completion data. Any required schedule modifications will be discussed in the quarterly progress reports to USEPA.

The Order requires that the RFI Report be submitted to USEPA within 90 days of completion of RFI activities. The final RFI activity will be completion of the risk assessment. The risk assessment is scheduled to be completed within 90 days of the completion of data validation. Data validation will be completed within 90 days of the last field sampling event. Therefore, the due date for the RFI Report will be established at 270 days from the date of the last field sampling event.

A.7 Quality Objectives and Criteria for Measurement Data

A.7.1 Data Quality Objectives

Data Quality Objectives (DQOs) are comprehensive statements that specify the quality and quantity of the data required to support decisions made during the investigation activities. The DQOs are based on the ultimate use of the data to be collected. Because of this, different data uses may require different quantities of data and different levels of quality. The DQO process for the RFI is described below, following the general steps outlined in the USEPA's *Guidance for the Data Quality Objectives Process, EPA/QA/G-4*.

A.7.1.1 Problem Statement

The DQO planning team members include the BT^2 project manager, QA officer, and technical coordinator, and the laboratory QA officer. The DQOs will be reviewed by the WDC project coordinator and the USEPA Project Manager and QA Reviewer.

The problem is to determine whether environmental contamination related to any releases from the facility poses an unacceptable risk to human health or the environment. For each area of investigation (one or more SWMUs or AOCs), the questions to be answered for each contaminant of concern include:

- What exposure pathways are potentially complete now or in the future?
- For those potentially complete exposure pathways, are contaminant concentrations at a level that poses an unacceptable risk to human health or the environment?

Potential exposure pathways were evaluated in the CCR based on existing information. The preliminary exposure evaluations are discussed with respect to the sampling design in **Section B.1**.

To minimize project costs, the RFI needs to be completed in an efficient and cost-effective manner. A phased approach focused on providing the data needed to complete the risk assessment is proposed. The proposed schedule is shown on **Figure 4**.

A.7.1.2 Decision Identification

The decision statement for the RFI is to determine whether environmental contamination related to any releases from the facility poses an unacceptable risk to human health or the environment. If unacceptable risks are present, then corrective measures are needed.

As described above, this decision statement can be broken down to the level of an individual SWMU, contaminant, and exposure pathway.

A.7.1.3 Decision Inputs

Decision inputs for the evaluation of the environmental contamination questions identified in the problem statement will include the following types of information:

- What exposure pathways are potentially complete now or in the future?
  - Extent of contamination
  - Depth of contamination
  - Receptor locations
  - Rate and direction of contaminant movement
- For those potentially complete exposure pathways, are contaminant concentrations at a level that poses an unacceptable risk to human health or the environment?
  - Contaminant concentrations in soil, groundwater, or other affected media at the point of exposure
  - Preliminary remediation goals developed as described in the Risk Assessment Workplan

Because the site-specific preliminary remediation goals will be developed as part of the RFI, they are not available yet to be used in the DQO process. To provide a conservative basis for selecting appropriate sampling and analytical methods, existing screening action levels will be used. Because the site-specific preliminary remediation goals are expected to be similar to or higher than the screening action levels, data that meets the quality objectives for the screening action levels will be more than adequate for comparison with the preliminary remediation goals.

Screening action levels to be used in selecting sampling and analytical methods include the following:

- USEPA Regional PRGs or RBCs
- USEPA Eco-SSLs
- Typical soil background concentrations
- USEPA Maximum Contaminant Levels for Drinking Water

The screening action levels for soil and groundwater are summarized in **Tables 2** and **3**. The proposed analytical methods and the anticipated method detection limits are also provided in these tables. The analytical methods were selected such that the anticipated limit of quantitation is less than the lowest of the possible screening action levels where possible. If this objective could not be achieved, the lowest detection limit that could be obtained with a reasonably available standard method was selected.

A.7.1.4 Investigation Boundary

The geographic limits of the RFI include the WDC facility and adjacent off-site properties to which contaminant releases may have spread. More specific investigation areas are described for each area of investigation in the discussion of sampling process design in **Section B.1**. If off-site investigation is needed, it will be subject to the constraint of obtaining access permission from the property owner(s).

The time period for sampling will be as outlined in the proposed project schedule on **Figure 4**. There are no anticipated time constraints on sampling, except that it may not be feasible to collect surface soil samples when the ground is frozen in the winter. For the assessment of current or potential risk associated with the contaminants released from the facility, the time period will include future conditions and use as well as present.

A.7.1.5 Decision Rule

The overall decision rule for the RFI is:

- If contaminant releases from the facility pose unacceptable risks to public health or the environment, then corrective measures are required.

This decision comprises many individual decisions to be made through the risk assessment process, as outlined in the Risk Assessment Work Plan and in the sampling process design in **Section B.1**. To make this decision, the extent and degree of contamination must be adequately defined and the contaminant releases adequately characterized to allow evaluation of the public health or environmental risk.

A.7.1.6 Decision Error Limits

The baseline condition (null hypothesis) is that the facility does not pose an unacceptable risk to public health or the environment. The two types of potential decision errors are:

- False rejection: Decide that the facility does pose an unacceptable risk when in fact it does not.
- False acceptance: Decide that the facility does not pose an unacceptable risk when in fact it does.

Decision errors can be minimized by appropriate sampling process design and good quality assurance for field and laboratory data.

A.7.2 Measurement Data Quality Criteria

Field and laboratory measurement data for this project will be assessed in terms of precision, accuracy, representativeness, completeness, and comparability.

Field measurements will include the following types of information:

- Sampling locations and depths
- Depth to water in monitoring wells
- Temperature, specific conductance, dissolved oxygen content, oxidation-reduction potential, turbidity, and pH of groundwater and surface water
- Photo-ionization detector screening for volatile organic compounds (VOCs) (sample headspace and breathing zone)

Laboratory analysis will be based on the sampling process design outlined in **Section B.1** and will include the contaminants of concern listed in **Tables 2** and **3**. A mobile laboratory will also be used for the VOC investigation area.

A.7.3 Precision

Precision is a measure of the reproducibility of measurement under a given set of conditions. It is a quantitative measure of the variability of a group of measurements compared to their average value. Depending on the end use of the data, precision is reported as Relative Percent Difference (RPD) or standard deviation. For a sample and a duplicate, relative percent difference is calculated as:

$$RPD = 100 \text{ x } Abs((R_1 - R_2) \text{ x } 2\ ) / (R_1 + R_2)$$

where R_1 and R_2 are the two results and "Abs" denotes the absolute value.

A.7.3.1 Field Measurement Precision Objectives

The objectives for field measurement precision are summarized in **Table 4**. Field measurement precision is a function of the equipment used, so the proposed equipment is also listed in **Table 4**.

Field sampling precision will also be assessed through the collection and analysis of field duplicate samples. The frequency of duplicate samples is shown in **Table 5**, along with other quality control (QC) sample collection and analysis frequencies. For monitoring well groundwater samples, a minimum of one field duplicate will be collected for each 20 samples collected. Duplicate samples will also be collected for geoprobe boring water samples at a rate of one duplicate per 20 samples, if sufficient sample volume for a duplicate sample is reasonably available. However, if low permeability soils make it difficult to collect groundwater samples in a reasonable period of time, then field duplicates will not be collected for the geoprobe groundwater samples. For groundwater samples, the RPD objective is less than 20%.

Duplicate samples will also be collected for soil samples at a rate of one duplicate per 20 samples. Due to soil heterogeneity, the agreement between soil duplicate sample results is generally lower than for water samples. For geoprobe boring samples, duplicate samples will be collected by splitting the core lengthwise and collecting the sample and duplicate from the two halves at the same depth. For surface soil samples (non-VOCs), the duplicate will be collected by placing soil for both samples in a mixing bowl, mixing, and collecting the two samples from the bowl. For soil samples, the RPD objective is less than 35%.

A.7.3.2 Laboratory Precision Objectives

The precision of laboratory analyses will be measured based upon laboratory matrix spike/matrix spike duplicate (MS/MSD) analyses. Precision is reported as RPD. MS/MSD analyses will be either at a rate of 1 per 20 samples received by the laboratory or in accordance with laboratory Standard Operating Procedures (SOPs). TestAmerica's laboratory precision objectives for specific analyses are provided in **Appendix B**. Matrix Environmental's mobile laboratory precision objectives are described in **Appendix C**.

A.7.4 Accuracy

A.7.4.1 Definition

The definition of accuracy is the degree of agreement between a measurement or observed value and an accepted reference or true value. The field and laboratory accuracy objectives are identified below.

A.7.4.2 Field Accuracy Objectives

Sampling accuracy will be assessed by evaluating the results of field and trip blank samples for contamination. A trip blank will consist of a laboratory-prepared sample of reagent grade water. Trip blanks will accompany sample containers and be subjected to the same procedures as the investigative samples. Trip blanks are only required when VOCs will be analyzed. Trip blanks will be submitted for analysis at the rate of one trip blank per shipping container containing investigative samples for VOC analyses.

Field equipment blanks will be collected by pouring laboratory-grade water over or through the sampling equipment and collecting the rinsate in the proper analytical containers. Field equipment blanks for soil VOC sampling will be collected with methanol rather than water. Field equipment blanks are required at the rate of one per 20 investigative samples with a minimum of one per soil or groundwater sampling event.

Field bottle blanks will be collected by pouring laboratory-grade water into the proper VOC sample containers at the field sampling location. Field bottle blanks are required for VOC analysis in water samples. Field bottle blanks are required at the rate of one per 20 investigative samples, with a minimum of one per groundwater sampling event.

Methanol blanks will be collected by pouring methanol into the proper VOC soil sample containers at the field sampling location. Methanol blanks are required only when soil samples collected for VOC analysis are preserved with methanol. Methanol blanks are required at the rate of one per 20 investigative samples, with a minimum of one per soil VOC sampling event.

A.7.4.3 Laboratory Accuracy Objectives

The analysis of MS/MSD samples can be utilized to determine laboratory accuracy. In addition, the analysis of reference standard samples, laboratory control samples, surrogate compounds, and percent recoveries are also utilized for laboratory accuracy determinations. TestAmerica's laboratory accuracy objectives for specific analyses are provided in **Appendix B**. Matrix Environmental's mobile laboratory accuracy objectives are described in **Appendix C**.

A.7.5 Representativeness

A.7.5.1 Definition

The degree to which data accurately and precisely represents a characteristic of a population, parameter variations at a sampling point, or an environmental condition, defines representativeness. Field and laboratory representativeness are described below.

A.7.5.2 Measures to Ensure Representativeness

Representativeness is dependent upon the proper design and implementation of the sampling program. The QA goal will be to have all samples and measurements representative of the media sampled. The sampling design is discussed in **Section B.1** and sampling procedures are outlined in **Section B.2** and

Appendix D. Factors that may affect representativeness and proposed strategies to enhance representativeness include the following:

1. Environmental conditions at the time of sampling
    a. Collect at least two rounds of groundwater samples from monitoring wells to allow for temporal variations (minimum of 3 months apart).
    b. Do not collect surface soil samples when the ground is frozen.
    c. For any subsurface soil samples or water samples, minimize the time that samples are exposed to the atmosphere.
    d. Record environmental conditions so that possible effects can be considered during data validation.
2. Number of sampling points
    a. For VOC investigation, use a mobile lab to provide "real-time" results to ensure adequate sampling point coverage.
    b. Use a phased approach to avoid under-sampling or over-sampling, because the required number of sample points cannot always be known in advance.
    c. Use existing data to guide the design of the additional sampling program.
3. Representativeness of selected media
    a. Choose sampling media based on potential exposure pathway analysis and conceptual site model.
    b. Consider geologic characteristics observed in soil borings when selecting final depths (e.g., look for preferential pathways such as sand seams when trying to define maximum extent of VOC contamination).
    c. Purge monitoring wells prior to sampling to obtain representative groundwater.
4. Representativeness of selected analytical parameters
    a. Choose analytical parameters based on previous sampling that indicates a potential concern.
    b. Add parameters as needed based on known release parameters (e.g., expand groundwater monitoring parameter list for former chromium aboveground storage tank (AST) area to include other metals that may have been mobilized by lowered pH due to acid releases).
    c. Choose parameters needed for risk assessment (e.g., analyze chromium VI in addition to total chromium to account for widely differing toxicity of chromium III versus chromium VI).

A.7.6 Completeness

A.7.6.1 Definition

Completeness provides a measure of the quantity of valid data obtained from a measurement system compared to the quantity that was expected under normal conditions. Although a completeness goal of 100 percent is desirable, a realistic criterion of less than 100% allows for acceptance of the sampling program results even if some data are unavailable or not valid due to sampling or analytical problems.

A.7.6.2 Completeness Objectives

Completeness will be a measure of the quantity of valid data measurements and analyses obtained from all the measurements and analyses completed for the project. The laboratory completeness objective is for 90 percent of the samples analyzed to be valid data. The significance of incomplete data will depend on the specific locations and parameters missing and will be evaluated further as part of the data validation process.

A.7.7 Comparability

A.7.7.1 Definition

The confidence with which one data set can be compared to another is a measure of comparability. The ability to compare data sets is critical for the RFI because RFI data will be gathered using a phased approach and existing data will be used to the maximum extent feasible.

A.7.7.2 Measures to Ensure Comparability

The comparability of field data will be ensured by adhering to the SAP/QAPP and following field and laboratory SOPs. Verification and validation of new and existing data in accordance with the procedures outlined in **Section D.2** will also help ensure comparability. In addition to following standard procedures, specific strategies for ensuring comparability of existing data and data gathered for the RFI include:

- Using a consistent field sampling team to the extent reasonably possible
- Using field sampling procedures consistent with past sampling for monitoring wells where feasible
- Using the same laboratory to the extent feasible

- Using the same laboratory for the RFI that has performed previous analysis of groundwater samples from the landfill monitoring wells and former chromic acid AST area wells (TestAmerica, Cedar Rapids office)
- Using consistent laboratory methods

A.8 Special Training Requirements and Certifications

The OSHA 40-hour HAZWOPER certification and subsequent annual 8-hour refresher courses will be required of all personnel conducting or supervising sampling activities. No other special training requirements have been identified for this project.

A.9 Documentation and Records

Records that will be generated as part of the subsurface investigation are a critical aspect of a successful project. BT^2 will use select documents for recording information during project activities. Records to be a part of the project documentation for the investigation include field forms, field logbooks, laboratory data sheets, COC forms, calculations, correspondence and reports. In accordance with the Order, the records will be maintained by WDC for a minimum of six years following the termination of the Order.

In accordance with the Order, quarterly progress reports will be submitted to the USEPA Project Manager. The quarterly progress reports summarize work completed, contacts made, problems encountered, actions taken, changes in project personnel, projected work, and data generated during the reporting period.

The draft and final RCRA Facility Investigation Report submittal packages will include the information outlined in under Task 3 in Attachment 2 to the Order, including the following major elements:

- Environmental Setting
- Source Characterization
- Contamination Characterization
- Potential Receptors/Risk Assessment

The contaminant characterization will address the direction and velocity of both horizontal and vertical contaminant movement, as well as extrapolation of likely future contaminant movement for groundwater, soil, surface water, and sediment.

Data will provided in tables and on figures as described in the Data Management Plan. Appendices will include laboratory reports, soil boring logs, monitoring well construction forms, borehole abandonment reports, monitoring well development forms, and other relevant data.

GROUP B: MEASUREMENT DATA ACQUISITION

This section of the SAP/QAPP outlines the specific sampling approach, field procedures, and laboratory procedures to be used in the RFI.

B.1 Sampling Process Design

To streamline the investigation process and meet the objectives of the RFI, investigation areas will be defined at the WDC facility. These investigation areas include the nine SWMUs and two AOCs identified in the CCR as requiring additional investigation, grouped into investigation areas based on location and waste type. The following sections provide sampling plans for each investigation area.

B.1.1 Former Chromic Acid AST/Dump Pit Area (SWMU 4 and SWMU 11)

The objectives of sampling in the former chromic acid AST/dump pit area are to determine the degree and extent of chromium contamination in soil and groundwater, to characterize the contamination with respect to the type of chromium contamination (chromium III or chromium VI) and other contaminants that may be present, and to evaluate the risk associated with contaminated soil and groundwater.

The exposure pathway evaluation for the former chromic acid AST/dump pit area is shown on **Figure 5**. For soil, the only potential exposure pathways appear to be ingestion or dermal contact by a construction worker during excavation in the area, or by a future industrial/commercial worker, if contaminated soils are not covered by an asphalt or clean soil cap in the future. Current site workers are protected by the asphalt paving over the areas where soil contamination remains. Additional soil sampling will include sampling in the depth interval from the surface to approximately 6 feet below ground surface (bgs), which is the approximate depth of the water table in this area of the site.

For groundwater, surface water, or sediment, a complete exposure pathway will be present only if groundwater contamination associated with this source extends off-site to residential water users or discharges to surface water at the Middle Platte River, or if construction workers are exposed to groundwater during on-site excavation (e.g., for utility installation). The groundwater sampling objective will be to determine the type and extent of groundwater contamination associated with this source.

To satisfy the objectives for soil in this investigation area, four Geoprobe ™ (geoprobe) soil borings will be advanced in the area to a depth of 6 feet bgs. The proposed boring locations are shown on **Figure 6**. The boring locations are selected to provide sufficient information, in addition to existing data for the area, to determine the extent of chromium soil contamination above the water table. It is anticipated that the water table will be encountered at a depth of approximately 6 feet bgs in this area.

Soil will be sampled continuously using geoprobe sampling tools. Soil samples will be described by a BT^2 field geologist on a soil boring log in terms of color, soil type (Unified Soil Classification System), odor, and any soil structures that may exist.

Three soil samples will be collected for laboratory analysis from each soil boring. One soil sample will be collected from a depth of 0 – 6 inches bgs (surface), one soil sample will be collected from a depth of 2 to 4 feet bgs, and one will be collected from a depth of 4 – 6 feet bgs in each of the four soil borings. These depths were selected to characterize the potential risk to a construction worker. The samples will be submitted for laboratory analysis for chromium VI and total chromium.

To satisfy the objectives for groundwater in this investigation area, existing monitoring wells will be sampled. Four monitoring wells (MW1 through MW3 and MWA) currently exist in this investigation area (**Figure 6**). These four wells will be sampled in three events. In the first two events, groundwater samples will be collected from the wells and submitted for laboratory analysis for chromium VI, all inorganic compounds found in Appendix IX of 40 CFR Part 264 (see **Appendix E** for list), nitrate+nitrite as nitrogen, sulfate, fluoride, chloride, and VOCs. These parameters were selected to include components of the acids that were potentially released in the area plus additional metals that could potentially have been mobilized due to acidic conditions (low pH). In the third sampling event, the samples will be analyzed only for inorganics detected above the risk-based screening levels in **Table 3** at least one of the wells in one of the first two sampling events, and samples will be collected for VOC analysis only at wells where VOCs were detected above a risk-based screening level in one of the first two sampling events. The complete monitoring well sampling program is summarized in **Table 8**.

In addition to sampling these four wells, the existing monitoring well network around the site landfill will be used to determine the extent of groundwater contamination related to the former chromic acid AST and dump pit area. The landfill wells are downgradient of this investigation area. There are currently 13 monitoring wells (MW6 through MW18, see **Figure 2**) for the landfill, seven of which are sampled on a semiannual schedule as part of the routine landfill groundwater monitoring required by the Iowa

Department of Natural Resources (IDNR). After the results of the first round of source area well sampling have been reviewed, the next two semiannual groundwater sampling events at the existing landfill wells will be modified to include analysis for parameters associated with potential contamination from the chromic acid AST and dump pit area. The groundwater monitoring program for the landfill monitoring wells is discussed in **Section B.1.4** and the complete groundwater monitoring well sampling program is summarized in **Table 8**.

If needed to achieve the sampling objectives for the former chromic acid AST and dump pit area, additional sampling could include:

- Additional geoprobe soil borings to define the extent of soil contamination
- Additional monitoring well installation or sampling of monitoring wells installed in other investigation areas for the chromic acid AST area analytical parameters

B.1.2 Magnesium Dross Storage and Treatment Areas (SWMU 8 and SWMU 9)

The objectives of sampling in the magnesium dross storage and treatment areas are:

- To characterize the untreated dross and evaluate the potential for dross to cause contamination
- To evaluate whether soil has been contaminated above applicable standards
- To evaluate whether surface water has been contaminated above applicable standards
- To evaluate whether sediments have been contaminated above applicable standards
- To evaluate whether groundwater is contaminated above applicable standards due to dross
- To evaluate whether petroleum contamination is present in the used oil tank area

The exposure pathway evaluation for the magnesium dross storage and treatments areas is shown on **Figure 7**. Potentially complete pathways include industrial worker or construction worker exposure to surface soil or wind-blown dust. To evaluate the risk associated with this potential pathway, surface soil contaminant concentrations need to be evaluated. Possible ecological risk to terrestrial biota will depend on the surface soil concentrations and the biota present in the area.

For groundwater, surface water, or sediment, a complete exposure pathway will be present only if groundwater has been contaminated by this source and contamination extends off site to residential water users or discharges to surface water at the Middle Platte River, or if contamination is present in stormwater drainage (surface water or sediment) from the dross storage and treatment areas. The groundwater, surface water, and sediment sampling objectives will be to determine the type and extent of contamination of these media associated with this source, if any.

To characterize the untreated dross, a composite sample will be collected from stockpiles and storage containers in the dross storage area. The composite dross sample will be submitted for laboratory analysis for the complete list of metals found in **Table 5-13** in **Appendix B**.

The first step in evaluating the soil for potential dross contamination will be the collection of surface soil samples in the area. Sample locations will be located on a 50-foot by 50-foot grid, as shown on **Figure 8**. The sampling grid will exclude paved areas and the radiological investigation area. Soil samples will be collected from each of the 18 grid nodes. If a sample location cannot be accessed, the sample location will be moved to the nearest accessible area. Soil samples will be collected at each sample location from depth of 0 to 2 inches bgs and from a depth of 6 to 12 inches bgs. The samples will be submitted for laboratory analysis for barium, chromium VI, and total chromium, as well as any other metals detected in the dross sample at concentrations greater than the lowest risk-based screening level for that metal as indicated in **Table 2**.

If the results of the surface soil sampling indicate that soil contamination from dross is present at the site at concentrations exceeding the applicable soil screening levels, then geoprobe soil borings will be installed to investigate the extent of the soil contamination. The purpose of the borings in the dross area is to evaluate the vertical extent of soil contamination above the water table at locations where the surface soil sampling indicates contamination is present above risk-based screening levels. We estimate that five soil borings will be adequate to determine the vertical distribution of contamination in the primary contamination areas, if encountered, and to provide general information on the tendency for surface contamination is the dross area to migrate vertically through the soil.

The five soil borings will be advanced to a depth of 8 feet bgs. The borings will be located in areas where contamination was detected in the surface soil sampling results. Three soil samples will be collected from each boring for laboratory analysis for barium, chromium VI, and/or total chromium, , as well as any other metals detected in the surface soil samples at concentrations greater than the lowest risk-based screening level for that metal as indicated in **Table 2**. The three soil samples from each boring will be collected from depths of 0 to 6 inches bgs (to evaluate industrial worker exposure), 2 to 4 feet bgs, and 4 to 6 feet bgs (to evaluate construction worker exposure).

If the results of the surface sampling and initial geoprobe borings are not adequate to define the horizontal and vertical extent of soil contamination above risk-based screening levels, then additional boring locations and sampling depths will be selected based on the initial sampling results. If the results of the soil sampling indicate that contaminants are not present in the soil at concentrations exceeding the applicable soil screening levels, no further soil investigation will take place.

To investigate the potential for groundwater contamination, one water table monitoring well will be installed in the dross treatment area to assess the groundwater quality. The monitoring well will be installed upgradient from the landfill. The proposed well location is shown on **Figure 8**. The well will be sampled twice in conjunction with other groundwater sampling at the facility. The groundwater samples will be submitted for laboratory analysis for Appendix IX inorganics, chromium VI, chloride, sulfate, fluoride, nitrate+nitrite, and VOCs, except that the second round sample will be analyzed for VOCs only if VOCs are detected in the well at concentrations exceeding the risk-based screening levels in **Table 3** during the first round.

To investigate the potential for surface water contamination, one surface water sample will be collected from stormwater in the vicinity of the dross treatment area during a stormwater runoff event. The proposed sampling location is in a drainage ditch receiving stormwater runoff from the dross treatment area, as shown on **Figure 8**. The analytical parameters will include those parameters detected above a risk-based screening level in the dross sample and/or soil sample analysis. The analytical results for the surface water sample will be used to determine if further surface water sampling in the area is warranted.

To investigate the potential for sediment contamination, one sediment sample will be collected from the same location as the surface water sample. The analytical parameters will include those parameters detected above a risk-based screening level in the dross sample and/or soil sample analysis. The analytical results of the sediment sample will be used to determine if further sediment sampling in the area is warranted.

Although the used oil AST is located within the magnesium dross storage and treatment area, it is a separate potential contamination source. Initial investigation of this source will include three geoprobe borings located approximately as shown on **Figure 8**. The boring locations may be adjusted in the field based on access limitations or field observations indicating possible contamination (e.g., stained soil or stressed vegetation). The geoprobe borings will be advanced to a total depth of approximately 12 feet bgs. Soil samples will be collected continuously and field screened using a photo-ionization detector

(PID). Two soil samples will be collected from each boring for laboratory analysis for VOCs, polynuclear aromatic hydrocarbons (PAHs), lead, cadmium, total chromium, and chromium VI. The two soil samples from each boring will be collected from depths of 0 to 6 inches and 4 to 6 feet, unless alternative depths are chosen based on field screening results or visual observations. The water table is anticipated to be at a depth of approximately 6-8 feet in this area. A groundwater sample will be collected from each boring location unless this is impracticable due to low permeability soils. The groundwater sample will be analyzed for VOCs, PAHs, lead, cadmium, total chromium, and chromium VI.

If needed to achieve the sampling objectives for the magnesium dross storage and treatment area, including the used oil AST area, additional sampling could include:

- Additional surface soil sampling or geoprobe soil borings to define the extent of soil contamination
- Sampling of additional monitoring wells installed in other investigation areas, such as the landfill, for the magnesium dross area analytical parameters
- Installation and sampling of one or more monitoring wells in the used oil AST area

If a monitoring well is installed in the used oil AST area, it will be screened at the water table because this is the depth where oil contamination is most likely to be encountered. If petroleum contamination is present in groundwater in this area, additional geoprobe sampling and/or monitoring well installation will be completed as needed to define the extent of contamination.

B.1.3 Current Wastewater Treatment Sludge Storage Area (SWMU 2)

The objectives of sampling in the Current Wastewater Treatment Sludge Storage Area are to determine if there has been a release to the environment, and if so, whether the release poses a risk to human health or the environment. An exposure pathway analysis diagram was not prepared for this area, because there is no evidence of a release and the likelihood of contamination appears low. If surface spills have occurred, the potential pathways are similar to those for the dross storage area (**Figure 7**).

To determine if there has been a release to the environment in this area, soil samples will be collected from 4 locations as shown on **Figure 9**. The number and location of samples for SWMU 2 was chosen as a reasonable initial sampling effort to determine if there has been a release from this SWMU. The wastewater treatment sludge is stored in a lined roll-off box and there have been no known releases. To investigate whether a release has occurred, one sample will be collected from each side of the roll-off box. Samples will be collected from unpaved areas and actual sample locations will be selected based on the likelihood of a spill or leak as determined by field observations. Two soil samples will be collected from each sample location at depths of 0 to 2 inches bgs and 6 to 12 inches bgs. The soil samples will be submitted for laboratory analysis for total chromium and chromium VI. Because the purpose of this sampling is to determine whether or not a release has occurred, and because chromium is the primary constituent of the waste in this area, total chromium and chromium VI will serve as indicators of a release. For these reasons, we do not propose analyzing these samples for additional metals.

If the shallow soil sampling indicates that a release has occurred and maximum chromium concentrations exceed the risk-based screening levels in **Table 2**, then geoprobe soil borings will be used to investigate the extent of contamination from SWMU 2. If geoprobe borings are necessary in this area, we propose to install 2 to 4 borings to 6 feet bgs (approximately the water table). The actual number and locations of borings will be dependent on the results of the shallow soil sampling and observed field conditions. Soil samples will be collected at 2-foot intervals from each boring. The shallow sample (0 to 2 feet bgs) from each boring will be submitted for laboratory analysis for the list of metals found in **Table 5-13** of **Appendix B**. The intermediate (2 to 4 feet bgs) and deep (4 to 6 feet bgs) samples will be held frozen pending the results of the shallow samples. If metals are detected in the shallow samples at concentrations greater than the risk-based screening levels found in **Table 2**, then the intermediate and deep samples will be submitted for laboratory analysis for those metals.

If the surface soil sampling results indicate that a release from SWMU 2 has occurred, a groundwater sample will be collected from one of the geoprobe borings and submitted for laboratory analysis for the Appendix IX inorganic parameters (see list in **Appendix E**).

B.1.4 Landfill Groundwater Impacts (SWMU 12)

The objectives of sampling in the area of landfill groundwater impacts are:

- To evaluate the risk associated with fluoride and sulfate impacts to groundwater as a result of landfill operations
- To determine the extent of landfill groundwater impacts
- To evaluate the potential for discharge of contaminants to surface water and sediment
- To evaluate background groundwater conditions to determine the degree of groundwater impacts, with specific attention paid to background sulfate concentrations

The exposure pathway evaluation for the landfill groundwater impacts is shown on **Figure 10**. The only potential on-site exposure pathway for landfill groundwater contamination is construction worker dermal contact in the event of excavation below the water table. Off-site exposure pathways will be complete only if groundwater contamination extends to residential water supply wells or if contaminated groundwater discharges to the Middle Platte River.

To evaluate potential analytical parameters for the landfill, we compiled available information regarding the foundry sand components and available analytical data for the sand and the landfill leachate. Both dry sand and green sand have been disposed of in the landfill. Dry sand is used almost exclusively today, but green sand was used predominantly at some time in the past. The dry sand contains 97% silica sand and 3% binders and inhibitors. A flow chart showing the mix ratios is provided in **Appendix G**, along with Material Safety Data Sheets (MSDSs) for the binders and inhibitors currently used. The primary binder components include phenols, aromatic hydrocarbons, ester solvents, and diisocyanates. The inhibitor components include potassium fluoroborate, graphite, and sulfur.

The green sand is currently mixed from approximately 99% sand and 1% binders. The binder components include Bondtone® (organophilic clay), potassium fluoroborate, heavy paraffinic petroleum oil, and sulfur. An MSDS for the oil currently used is provided in **Appendix G**.

Analytical results for testing of the dry sand for metals are summarized in **Table 9**. No metals were detected in the sand at levels exceeding risk-based screening levels, and no RCRA metals were detected in the leachate from a Toxicity Characteristic Leaching Procedure (TCLP) test.

Analytical results for the landfill leachate are summarized in **Table 10**. This table includes the leachate piezometer monitoring results that were in Table 8 in the CCR, plus some additional results for leachate samples analyzed for metals, VOCs, and semivolatile organic compounds (SVOCs). Table 9 of the CCR included additional monitoring results for the leachate discharge to the sanitary sewer, but this monitoring is for a limited parameter list. Based on the results in **Table 10**, only a few metals, VOCs, and SVOCs were detected above risk-based screening levels in the leachate, and many of those were detected in only one of several samples collected. In the SVOC analysis, the parameters detected in more than one leachate sampling event included only naphthalene and two phenols, and only naphthalene was above the risk-based screening level (EPA Region 9 PRGs for tap water). Based on these results, the potential for groundwater contamination with metals, VOCs, or SVOCs due to the leachate appears to be limited to a few parameters; however, we are proposing a limited source area sampling program to screen groundwater in the wells most likely the be affected by the landfill for a large list of analytical parameters.

The existing data from the routine semiannual landfill monitoring program will be supplemented by installing six new monitoring wells downgradient of the landfill along the east and south property lines to evaluate the potential for off-site groundwater contamination. The three proposed well locations are shown on **Figure 11**. At each location, one water table monitoring well will be installed along with a deeper well. We propose to install the deeper wells to a depth of approximately 20 feet below the bottom of the water table wells. We propose a depth difference of 20 feet because that separation will place the deeper wells in a separate geological unit (unweathered till) than the water table wells (alluvium or weathered till) at the site and because the separation is similar to the separation distances between existing shallow and intermediate wells.

The routine semiannual landfill groundwater monitoring program approved by the IDNR, which includes seven of the existing landfill monitoring wells, will continue to be implemented. For a minimum of two sampling events, boron will be added to the IDNR analytical parameter list. Sampling for boron is proposed because it has been detected at elevated concentrations in the landfill leachate in the past (see Table 8 in CCR). The routine landfill analytical parameter list includes magnesium, sodium, fluoride, sulfate, chemical oxygen demand, chloride, iron, ammonia, phenols, total organic halogens, pH, specific conductance, and temperature.

For the RFI, additional monitoring of the landfill wells will be performed to evaluate whether other contaminants may be present and investigate the extent of contamination associated with the landfill and other contamination sources potentially upgradient from the landfill, such as the former chromic acid AST area or the VOC release area. The first round of sampling, conducted at the same time as the initial source area well sampling for the chromic acid AST area, will include the four shallow downgradient landfill monitoring wells, where previous sampling indicates potential landfill impacts (MW11, MW12, MW16, and MW17). These wells will be sampled for the full list of Appendix IX inorganics, hexavalent chromium, chloride, fluoride, sulfate, nitrate+nitrite, and semivolatile organic compounds (SVOCs). These results will be used to narrow the list of analytical parameters for the additional landfill monitoring wells, where landfill impacts appear to be limited or not present.

The second and third rounds of sampling will be coordinated with the routine landfill monitoring program and will include all of the landfill monitoring wells. The sampling program will be similar to that for the initial sampling of the shallow downgradient wells, except that sampling of the additional wells for Appendix IX inorganics, SVOCs, and VOCs will depend on the results in previous sampling rounds. In general, sampling parameters at the deeper or more distant monitoring wells will be limited to those detected above risk-based screening levels in the source area wells. The complete monitoring program, including the decision approach for sampling parameters, is outlined more specifically in **Table 8**.

If the results from the monitoring wells at the property line indicate that contamination likely extends off site at levels exceeding the preliminary remediation goals, then additional groundwater investigation will be performed. Additional investigation may include geoprobe groundwater sampling and/or additional monitoring well installation and sampling, depending on the specific results obtained and access to off-site properties.

If the groundwater monitoring results indicate a potential for contaminated groundwater to reach the Middle Platte River, five surface water samples and five sediment samples will be collected. The surface water and sediment sample locations will include:

- Existing surface water monitoring location SW01 (**Figure 2**)
- Middle Platte River upstream of the facility
- Middle Platte River at Highway 34
- Middle Platte River at Osage Street
- Middle Platte River downstream of the facility

Sampling of the upstream and downstream locations on the Middle Platte River is dependent upon obtaining access. Surface water and sediment samples will be submitted for laboratory analysis for fluoride, sulfate, barium, boron, and VOCs, as well as any metals detected in landfill monitoring well groundwater samples at concentrations exceeding risk-based screening levels (**Table 3**).

B.1.5 Chlorinated Solvents in Soil and Groundwater (AOC A), Petroleum ASTs (AOC B), and Waste Methanol Storage Area (SWMU 7)

The objectives of sampling in the areas of potential VOC contamination in soil or groundwater are:

- To evaluate the risk associated with VOC contamination in soil and groundwater
- To determine the extent of VOC contamination in soil and groundwater

The exposure pathway evaluation for the VOC contamination areas is shown on **Figure 12**. Potentially complete pathways include construction worker exposure to soil or groundwater contamination. For residential exposure to groundwater or ecological impacts via surface water or sediment, a complete exposure pathway will be present only if groundwater contamination associated with this source extends off site to residential water users or discharges to surface water at the Middle Platte River either under current conditions or likely future conditions. If groundwater contamination extends off site to residential areas, then vapor intrusion could also be a possible exposure pathway. The potential for significant vapor intrusion into the production building is low because there is no basement, and good ventilation is provided in order to ensure acceptable indoor air quality for the foundry operations.

The vapor intrusion exposure pathway will be evaluated in accordance with the *Draft Guidance for Evaluating the Vapor Intrusion to Indoor Air Pathway from Groundwater and Soils (Subsurface Vapor Intrusion Guidance)*, dated November 2002, with consideration for the property use.

In occupational settings where chemicals forming hazardous vapors are generally not a known or well-recognized part of employment (e.g., non-industrial settings such as commercial office buildings); or other non-residential settings where the general public may be present or regularly visit (e.g., schools, libraries, hospitals, hotels, and stores), the screening approaches in the draft vapor intrusion guidance will be used (typically with adjustments for appropriate non-residential parameters).

In occupational settings where chemicals forming hazardous vapors are routinely used as part of the regular operations (e.g., in industrial-type settings, such as operating chemical plants, refineries, and workplaces where solvents are widely used), it is generally expected, based on observations to-date, that vapor intrusion is likely to represent a minor contribution to the risk from vapor exposures that may already exist in the work place. These exposures are typically managed as routine occupational exposures under other authorities (particularly OSHA's). Where the lead regulatory agency for cleanup concludes that the facts of the situation indicate that vapor intrusion is not likely to contribute significantly to risk, EPA generally believes it unnecessary for the regulatory agency to address vapor intrusion as a pathway of concern.

To achieve the objectives for soil contamination, approximately 20 geoprobe borings will be advanced and sampled in the areas of potential VOC contamination. Preliminary boring locations are shown on **Figure 13**; however, final locations will be chosen based on the results of field screening, field laboratory analysis, and field observations. Only 17 proposed boring locations are shown on **Figure 13**. The remaining three locations will be determined based on field results of the initial borings. Soil samples for VOC analysis will generally be collected at depths of 1 to 2 feet and 4 to 6 feet to evaluate the potential construction worker exposure pathway and define the extent of soil contamination above the water table. Alternate depths may be selected if field screening indicates higher levels of contamination deeper or shallower.

The soil samples will be analyzed in the field using a mobile laboratory operated by Matrix Environmental, LLC, of Osseo, Minnesota. Duplicates of approximately 25% of the geoprobe samples analyzed by the mobile laboratory will be sent to TestAmerica for confirmation analysis.

In addition, soil samples will be visually examined for the presence of non-aqueous phase liquids (NAPL).

Groundwater samples will be collected with the geoprobe sampler at all boring locations except those that are in the immediate vicinity of existing monitoring wells. The groundwater samples will be analyzed for VOCs using the Matrix Environmental mobile laboratory, and duplicates of 25% of the samples will be sent to TestAmerica for confirmation.

Up to five water table monitoring wells and two piezometers will be installed and sampled in the VOC investigation area. Preliminary well locations are shown on **Figure 13**; however, final locations will be determined based on the results of the geoprobe soil and groundwater sampling and field observations. If sampling results or field observations suggest the potential presence of NAPL in an area, a monitoring well will be installed in that area to further investigate the potential NAPL.

An additional monitoring well will be installed in the vicinity of SWMU 7 if the groundwater results from the four geoprobe borings proposed in that area indicate that VOC concentrations are greater than the risk-based screening levels in **Table 3**.

Two of the new wells to be installed as part of the investigation of SWMU 12 will be located downgradient from the existing MW11 (**Figure 13**). Based on existing groundwater flow direction data for the facility, MW11 and the two new landfill wells will be located downgradient of the VOC investigation area. Soil and groundwater data collected during geoprobe soil boring activities in the VOC area will also be evaluated prior to well installation activities to ensure that the two new wells are located downgradient from VOC contamination. The two new wells will serve as sentinel wells to monitor groundwater quality near the downgradient property boundary.

The new wells will be sampled twice in conjunction with other facility groundwater sampling. During the first VOC groundwater sampling round, groundwater samples will be collected from all of the 33 site monitoring wells and submitted for laboratory analysis for VOCs and 1,4-dioxane. The second round will include only those wells where VOCs were detected in the first round or in the March 2005 VOC sampling of selected landfill monitoring wells (see **Figure 13**), and wells where 1,4-dioxane was detected in the first sampling round. Groundwater samples from the second VOC sampling round will be submitted for laboratory analysis for 1,4-dioxane only for wells where 1,4-dioxane was detected in the first round.

Sampling of the existing well network as well as installing and sampling new wells is intended to provide horizontal and vertical delineation of the extent of VOC contamination. If sampling results indicate that horizontal or vertical extent have not been adequately defined, additional wells and sampling will be designed to achieve the objectives of the RFI.

If needed to achieve the sampling objectives for the VOC areas, additional sampling could include:

- Additional geoprobe soil borings to define the extent of soil contamination
- Additional monitoring well installation or sampling of monitoring wells installed in other investigation areas for VOCs

B.1.6 Wastewater Treatment System (SWMU 6) and Waste Acid Collection Pit Area (SWMU 10)

The initial objective of sampling in the wastewater treatment system and waste acid collection pit area is to evaluate whether a release has occurred from either of these operation areas. If a release has occurred, then additional objectives will include determination of the extent of contamination and evaluation of the associated risk.

The exposure pathway evaluation for the waste acid collection pit area is shown on **Figure 14**. If a release has occurred, the potential for human or ecological exposure is very limited because the contamination would be below the building.

To evaluate whether a release has occurred, approximately four geoprobe borings will be advanced through the floor of the production building in the area of the waste acid collection pit. Three geoprobe borings will be advanced in the area of the wastewater treatment system. Potential boring locations are shown on **Figure 15**, but final locations will be determined based on access and underground utility locations. The numbers and locations of borings for the wastewater treatment system (SWMU 6) and the waste acid collection pit (SWMU 10) were chosen as a reasonable initial sampling effort to determine if there has been a release from these SWMUs. There are no known releases from these SWMUs. To evaluate whether a release has occurred from the waste acid collection pit (SWMU 10), four borings are proposed in order to cover the four sides of the pit and collect samples upgradient and downgradient from the pit. The evaluate whether a release ahs occurred from the wastewater treatment system (SWMU 6), the three proposed borings include one in the likely upgradient direction (northwest), one in the likely downgradient direction (southeast), and one in the vicinity of the buried sanitary sewer line carrying the treated wastewater.

Two soil samples will be collected from each boring. One sample will be collected from 0 to 6 inches below the bottom of the floor and a second sample will be collected above the water table at each boring location, typically from a depth of 2 to 4 feet. Soil samples will be submitted for laboratory analysis for the list of metals found in **Table 5-13** in **Appendix B**. One groundwater sample will be collected from each geoprobe boring and analyzed for the same metals plus chloride, fluoride, sulfate, and nitrite+nitrate. The groundwater samples will also be field-analyzed for pH and conductivity. Additional borings may be completed if the field pH results suggest that a release has occurred.

If laboratory results from the initial geoprobe sampling locations in the area of these two SWMUs indicate that a release has occurred and the extent of contamination above risk-based screening levels has not been defined, then additional geoprobe borings and/or monitoring wells will be used to complete the investigation.

B.1.7 Geologic and Hydrogeologic Characterization

In addition to the contamination characterization activities described above, additional field tasks will be performed to characterize the geologic and hydrogeologic setting. Specific field tasks to be performed include the following:

- Document the soils encountered in all geoprobe and monitoring well soil borings on soil boring logs in accordance with the procedures outlined in **Appendix D**

- Collect a total of 3 to 5 soil samples from the major soil types encountered at the facility and analyze for grain size distribution (sieve and hydrometer), Atterberg limits (fine-grained soil only), natural moisture content, total organic carbon, and cation exchange capacity
- Perform single-well hydraulic conductivity tests (slug tests) on all new monitoring wells installed for the RFI
- Collect at least two full rounds of water level measurements from all monitoring wells at the site including new wells to be installed for the RFI and existing monitoring wells

Water table maps, potentiometric surface maps, and geologic cross sections with water level information will be included in the RFI report. A table of vertical hydraulic gradient calculations will also be included. The total organic carbon and cation exchange capacity results will be used to evaluate the contamination attenuation capacity of the soils.

B.1.8 Background Soil Sampling

To evaluate the role of background in contributing to concentrations of inorganic parameters in on-site soils, a limited background soil sampling program is proposed. Background soil samples will be collected at the six locations shown on **Figure 16**. These borings will be advanced with a hollow-stem auger and sampled with a split-spoon sampler. These borings were originally planned as part of a geotechnical investigation related to the landfill, not as part of the RFI; however, the location of the borings north of the active areas of the WDC facility is appropriate for background soil sampling, so we plan to also use these borings for background sampling.

The background sampling parameters will be selected based on the results of the initial geoprobe soil sampling. Background samples will be collected for parameters that exceed risk-based screening levels in one or more on-site sampling locations, if published regional background concentration data indicate that background levels may be similar to or higher that the risk-based screening levels. For example, it is likely that background sampling will be performed for arsenic, because background concentrations typically exceed risk-based screening levels, as shown in **Table 2**. On the other hand, background sampling may not be performed for boron even if site concentrations exceed the risk-based screening level, because typical background levels are much lower than the risk-based screening level.

The background sampling depths will correspond to the depths at which concentrations above risk-based screening levels were detected in the site samples.

Background soil sampling will be performed during the same mobilization as the monitoring well installation, after the results of the geoprobe soil and groundwater sampling have been reviewed.

B.2 Sampling Methods Requirements

Sample collection activities will conform to BT^2's standard field procedures as presented in **Appendix D**, unless other project-specific procedures are specified in the SAP/QAPP. The following sections provide additional information for sampling and field activities not specifically described in **Appendix D**.

B.2.1 Dross Sampling

To characterize untreated dross, a composite sample will be collected from stockpiles and storage containers in the dross storage area. Because the quantity and location of untreated dross that will be available for RFI sampling cannot be known at this time, the specific compositing approach will be selected when the sampling is performed. The location(s) of stored untreated dross will be mapped and a random sampling approach including at least three and no more than ten sub-sampling locations will be used to create the composite.

Once the sub-sampling locations have been determined, an equal amount of dross will be collected from each location and placed in a clean, stainless steel bowl. The dross will be stirred with a stainless steel trowel or spatula to homogenize the sample. Following stirring, an amount of dross appropriate for the required laboratory analysis will be transferred to the appropriate sample container provided by the laboratory.

B.2.2 Soil Sampling

Soil boring installation, soil boring logging, and soil sample collection from soil borings will be completed as described in **Appendix D**. Subsurface soil samples will be collected from soil borings as described in **Appendix D**.

Surface soil samples to be collected from a depth of 0 to 2 inches will not be collected from soil borings. The procedure for collecting 0- to 2-inch surface soil samples will be to use a clean stainless steel hand trowel or shovel to remove surface vegetation. The shovel or trowel will then be used to transfer soil to a clean, stainless steel bowl. The soil will be stirred with a stainless steel trowel or spatula to homogenize the sample. Following stirring, an amount of soil appropriate for the required laboratory analysis will be transferred to the appropriate sample container provided by the laboratory. This method for surface soil sampling is not appropriate for soil samples to be analyzed for VOCs. Should it be necessary to collect surface soil samples for VOC analysis, soil will be placed directly into sample containers without stirring to prevent loss of volatiles.

B.2.3 Groundwater Sampling

We propose to sample facility water table monitoring wells by low-flow sampling procedures as described in Yeskis and Zavala (2002). Low-flow sampling will be conducted with a peristaltic pump. Pumping rate will be adjusted so that drawdown stabilizes at less than 0.33 feet. Purge water will be monitored for DO, pH, temperature, specific conductance, ORP, and turbidity. When field parameter values have reached stable levels, groundwater samples will be collected directly into the appropriate field containers. Acceptable stabilization ranges for field parameters will be in accordance with Yeskis and Zavala (2002). If field conditions do not allow stabilization at less than 0.33 feet of drawdown at the lowest practical pumping rate, drawdown will continue to be monitored to determine if stabilization of drawdown can be reached. If drawdown in a well exceeds 2 feet prior to stabilization, low-flow sampling will not be used to sample that well.

Existing landfill monitoring wells have dedicated inertial lift pumps manufactured by Waterra. For existing landfill wells that cannot be sampled by low-flow methods, these Waterra pumps will be used to purge the wells prior to sampling. These wells will be pumped dry and allowed to recover for up to 48 hours prior to sampling. The dedicated inertial lift pumps will be used to pump water directly into sample containers. For VOC sampling, a VOC sampling kit will be used as recommended by Waterra to minimize sample aeration.

New water table monitoring wells that are installed as part of the RFI and cannot be sampled by low-flow methods will have dedicated polyvinyl chloride (PVC) bailers. These bailers will be used to purge the wells prior to sampling. These wells will be bailed dry and allowed to recover for up to 48 hours prior to sampling. The dedicated bailer will be used to transfer water directly into sample containers. All VOC sampling conducted with bailers will use bottom-emptying devices to limit the loss of volatiles while water is transferred from the bailer to the sample container.

Previous data from the site indicate that wells screened below the water table (piezometers) are generally screened across formations having hydraulic conductivity (K) values of 10^{-6} cm/s or less. Given these low K values, low-flow sampling will not be possible in site piezometers, because water does not enter these wells rapidly enough to prevent excessive drawdown at practical pumping rates.

For this reason, all site piezometers will be sampled with dedicated Waterra pumps or dedicated bailers as described above. One exception, however, is that piezometers will not be bailed or pumped dry. To prevent exposing the screened interval to air, piezometers will be bailed or pumped until the water level is within one foot of the top of the screen.

All sampling activities will be conducted in a manner intended to minimize turbidity. In accordance with USEPA guidance, groundwater samples collected and submitted for laboratory analysis for the RFI will not be filtered. However, if significant turbidity is observed in samples, additional samples may be collected and field filtered to compare the results of filtered groundwater samples with unfiltered RFI groundwater data to assess the effects of filtering on the analytical results.

All groundwater sample containers will be provided by the laboratory.

B.2.4 Monitoring Well Construction

Groundwater monitoring wells installed for the RFI will be constructed in accordance with Iowa Administrative Code Chapter 110. Monitoring wells will be installed in boreholes drilled by hollow-stem auger and will be constructed of 2-inch Schedule 40 PVC with flush-threaded (non-glued) joints. Well screens for water table monitoring wells will be 10 feet long. Well screens for piezometers will generally be 5 feet long, unless field observations indicate permeable zones or fractures are unlikely in the screened zone, in which case a 10-foot screen will be used. Screen lengths for all wells will not be greater than 10 feet or less than 5 feet.

Monitoring wells will be installed with filter packs that extend 12 inches below the bottom of the screen and 18 inches above the top of the screen. An annular space seal consisting of at least 3 feet of expanding cement or bentonite grout will be placed above the filter pack. The annular space between the annular space seal and the frost line will be filled with expanding cement or bentonite. The remaining annular space will be filled with bentonite grout. Monitoring wells will be protected at the surface by metal casings that extend one foot below the frost line. Wells will be completed with vented well caps and locking protective caps.

B.2.5 Monitoring Well Surveying

Monitoring wells will be surveyed to determine casing elevation, ground surface elevation, and horizontal location. Accuracy for horizontal well locations will be $\pm$0.5 feet. Accuracy for ground surface and top-of-casing elevations will be $\pm$0.01 feet referenced to datum.

Soil sampling locations will be surveyed using a Trimble GeoXT Geographic Positioning System (GPS) with a Pathfinder Pro XRS receiver, or by an alternative method with equivalent or better accuracy (less than 0.5 meter).

B.2.6 Investigative Waste Management

Soil cuttings generated through soil boring and drilling activities will be placed in 55-gallon steel drums on site. Soil from different investigation areas will be kept separate. If analytical samples are collected through the process of soil generation (i.e., geoprobe soil borings), the results of those samples will be used to determine the appropriate disposal method for the soil cuttings. If analytical samples are not collected during soil generation (i.e., drilling for monitoring well installation), soil samples will be collected from the drummed soil for waste characterization.

If analytical results indicate that drummed soil has no detectable contaminants, the soil will be spread out on the site ground surface. If analytical results indicate that drummed soil contains detectable concentrations of contaminants but is not hazardous waste, the soil will be disposed at a sanitary landfill facility approved to accept this waste. If analytical results indicate that drummed soil contains listed hazardous waste or is characteristically hazardous waste, the soil will be disposed at a hazardous waste facility.

If investigation results indicate that future excavation will likely be necessary for an investigation area as part of a corrective measure at the facility, drummed soil from that area may be stored on site for future disposal at the time excavated soils are disposed.

Groundwater generated through development and purging of monitoring wells and water generated by equipment decontamination will be contained in 55-gallon steel drums on site. Analytical results of groundwater samples collected from monitoring wells will be used to determine the appropriate disposal strategy for monitoring well development and purge water. Water samples will be collected from decontamination water drums for waste characterization. Laboratory analytical results for water samples will be used to obtain permission to discharge investigative wastewater to the Creston Sanitary Sewer System.

If analytical results indicate that water from a given well had no detectable organic compounds and no inorganic compounds present at concentrations greater than background concentrations during that sampling event, then contained water from that well will be discharged to the site ground surface. Purge water from all wells will be contained during each sampling event pending the most recent analytical results.

B.2.7 Equipment Decontamination

Non-disposable sampling equipment will be decontaminated before use at the site and between each use. Equipment used to sample media for laboratory analysis for inorganic constituents will be decontaminated by washing in Alconox™ and water, then rinsing with water from a municipal water supply. A final rinse will be conducted with commercial grade de-ionized water.

Equipment used to sample media for laboratory analysis for organic constituents will be decontaminated by washing in Alconox™ and water, then rinsing with water from a municipal water supply, followed by a methanol rinse. A final rinse will be conducted with commercial grade distilled water.

Water used for decontamination will be contained for disposal in accordance with the procedure described in **Section B.2.6**.

B.3 Sample Handling and Custody Requirements

Custody procedures will be used to document the relevance and authenticity of field samples collected during the RFI. A sample is considered in custody if it is:

- In a person's possession,
- In view of the person after being in possession,
- Sealed in a manner that it can not be tampered with after having been in a physical possession, or
- In a secured area restricted to authorized personnel.

Custody will be documented using proper chain-of-custody (COC) procedures and forms. Various aspects of sample handling and shipment, as well as the proposed sample identification system and documentation, are discussed in the following subsections.

B.3.1 Sample Identification System

Sample containers will be labeled prior to being filled. Each sample label shall, at a minimum, indicate:

- Sample location ID

- Sample type
- Date/time of sample collection
- Sampler's initials
- Required analyses
- Type of preservative

All labels will be filled out with waterproof ink.

Sample locations will be identified with a prefix indicating the type of sample followed by a number indicating the specific location, as described in **Appendix D**. For the RFI geoprobe samples, the sample location ID will also denote the sample type (soil or water), the sample depth number, and the depth interval. Example sample location ID's include:

- Geoprobe boring soil sample: GB – Boring # - S – Sample Depth Number, Depth (e.g., GB-102-S-2, 4-6')
- Geoprobe boring groundwater sample: GB – Boring # - W – Sample Depth Number, Depth (e.g., GB-102-W-1, 8-10')
- Surface soil sample: SS – Sample Location # (e.g., SS-104)
- Monitoring well: MW – Well # (e.g., MW-12)
- Waste sample: WS – Waste Sample # (e.g., WS-105)

Sample locations for the RFI will be numbered beginning with 101 for each type of sample (e.g., SS-101) to avoid confusion with previous sample numbers.

B.3.2 Sample Handling

The possession and handling of samples will be documented from the time of collection to delivery to the laboratory. BT^2 field personnel are responsible for ensuring that COC procedures are implemented. Field personnel will maintain custody of all samples until they are relinquished to another custodian, the laboratory, or to the freight shipper.

B.3.3 Field-Specific Custody Procedures

The sample packaging and shipment procedures summarized below will insure that the samples will arrive at the laboratory with the COC intact. An example COC is attached in **Appendix D**.

Transfer of COC and shipment procedures for samples shipped or delivered to TestAmerica are as follows:

a) The field sampler is personally responsible for the care and custody of the samples until they are transferred or properly shipped. As few people as possible should handle the samples.
b) Samples to be shipped to a private laboratory are accompanied by a properly completed COC form. When transferring the possession of samples, the individuals relinquishing and receiving will sign, date, and note the time on the record. This procedure will be used to transfer custody samples from the sampler to another person, to a mobile laboratory, to the permanent laboratory, or to/from a secure storage area.
c) A COC record identifying the contents will accompany each cooler. Two copies of the COC form will be placed in a plastic bag and taped to the inside cover of the cooler. A third copy will be retained by the sampler.
d) Samples will be properly packaged for shipment and dispatched to TestAmerica for analysis. Shipping containers will be secured with tape and custody seals. The preferred procedure includes affixing custody seals to the front right and rear left corners of the cooler. The custody seals will be covered with clear plastic tape.
e) If the samples are sent by common commercial carrier, a bill of lading will be used. Receipts of bills of lading will be retained as part of the permanent documentation. Commercial carriers are not required to sign off on the custody form as long as the custody forms are sealed inside the sample cooler and the custody seals remain intact.
f) Samples will be packaged using appropriate packing materials and ice/blue ice.

For samples to be analyzed by the mobile laboratory, sample custody will be transferred directly from the field sampling team to the mobile laboratory analyst. The sampling team will complete a COC form for these samples for each day of sampling and the mobile laboratory analyst will sign off on the sample receipt at the end of the day for all samples received that day.

B.3.4 Documentation

Custody of samples shall be maintained and documented at all times. COC begins with the collection of the samples in the field. The documentation for each sample will include, at a minimum, the following information:

- COC form

- Sample Identification Label
- Shipping Documents (including air bill #)

B.3.5 Laboratory Chain-of-Custody Procedures

TestAmerica's laboratory COC procedures are described in **Appendix B**.

B.4 Analytical Methods Requirements

B.4.1 TestAmerica

Analytical methods to be used by TestAmerica for soil and groundwater sample analyses are summarized in **Tables 2** and **3** along with the anticipated quantification limits. TestAmerica's Quality Assurance/Quality Control Manual, provided in **Appendix B**, outlines the analytical method requirements, QA/QC procedures, and responsible personnel. Samples will be analyzed on a standard lab turnaround schedule.

B.4.2 Matrix Environmental

Matrix Environmental will use a mobile laboratory to provide on-site VOC analysis for soil and groundwater samples. The samples will be analyzed following SW-846 Method 8021. Anticipated reporting limits for soil and groundwater are provided in **Tables 2** and **3**. Matrix Environmental's Quality Assurance Program and their Standard Operating Procedure for field VOC analysis are provided in **Appendix C**.

B.4.3 Geotechnical Samples

A total of three to five soil samples from the major soil types encountered at the facility will be collected and analyzed by a qualified laboratory for grain size distribution (sieve and hydrometer), Atterberg limits (fine-grained soil only), and natural moisture content. The analysis procedures for these tests are described in the following American Society for Testing and Materials (ASTM) standards:

- D422-63: Standard Test Method for Particle-Size Analysis of Soils
- D2216-05: Standard Test Methods for Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass
- D4318-00: Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils

B.5 Quality Control Requirements

B.5.1 Field QC Requirements

Where applicable, QC checks will be strictly followed during the investigation through the use of replicate measurements, equipment calibration checks, and data verification by BT^2 field personnel. Requirements for field QA/QC samples are summarized in **Table 5**.

Field sampling precision and data quality will be evaluated through the use of sample duplicates, equipment blanks, VOC trip blanks, field bottle blanks, and methanol blanks. Sample duplicates provide precision information regarding homogeneity, handling, transportation, storage, and analyses. Equipment (rinsate) blanks will be used to assure that proper decontamination procedures have been performed and that no cross-contamination has occurred during sampling or transportation. VOC trip blanks will be used to assure that transportation of samples has not contaminated the samples with VOC constituents only. Methanol blanks will be collected to ensure the quality of the methanol used in the preparation of soil samples for VOC analysis.

If there is any discrepancy in the sample data, the WDC Project Coordinator and the BT^2 Project Manager will be notified and resampling of the questionable point scheduled, if deemed necessary.

B.5.2 Laboratory QC Requirements

Laboratory QC requirements for TestAmerica are outlined in **Appendix B**. The laboratory QA Manager will be responsible for reviewing QC data and implementing corrective action as necessary.

Laboratory QC requirements for the Matrix Environmental field laboratory are outlined in **Appendix C**. The field analyst and laboratory QA Manager will be responsible for reviewing QC data and implementing corrective action as necessary.

B.6 Instrument/Equipment Testing, Inspection, and Maintenance Requirements

The following field instruments will be used during RFI sampling activities:

- Thermo Environmental Instruments 580B Organic Vapor Meter with PID
- Electric water level indicator
- YSI Model 556 Multi-Probe System (or equivalent) with sensors for DO, temperature, specific conductance, pH, and ORP
- LaMotte Model 2020 Turbidity Meter (or equivalent)

The PID will be used to screen soil samples for organic vapors. The PID requires daily calibration using a commercial calibration standard. Routine maintenance for the PID includes daily charging of the battery, daily checking of the particulate filter, and cleaning of the PID lamp as necessary (**Table 6**).

The electric water level indicator requires daily testing. Routine maintenance for the water level indicator includes decontamination after each use and monthly cleaning of the electronic nodes.

The multi-probe meter and the turbidity meter will be used to monitor purge water from monitoring wells during low-flow sampling. These meters will also be used to measure field parameters of groundwater samples from wells that are not sampled by low-flow methods.

The multi-probe and turbidity meters require daily calibration using commercial calibration standards. Routine maintenance for the multi-probe meter includes daily inspection of the pH, specific conductance, temperature probes, DO, and ORP sensors (**Table 6**).

Inspections and maintenance of the laboratory equipment is the responsibility of the laboratory personnel and will be conducted in accordance with manufacturer specifications.

B.7 Instrument Calibration & Frequency

The calibration procedures to be employed for both the field and laboratory instruments used during the investigation at the WDC facility are referenced in this section.

The responsibility for the calibration of laboratory equipment rests with the laboratory. BT^2 field personnel are responsible for the calibration of BT^2 field equipment and field equipment provided by subcontractors.

Documented and approved procedures will be used for calibrating measuring and testing equipment. Widely accepted procedures, such as those published by USEPA, ASTM, or procedures provided by manufacturers in equipment manuals, will be used.

Calibrated equipment will be uniquely identified either by the manufacturer’s serial number, a BT^2 equipment identification number, or other means. This identification, along with a label indicating when the next calibration is due (only for equipment not requiring daily calibration), will be attached to the equipment. If this is not possible, records traceable to the equipment will be readily available for reference. It will be the responsibility of all equipment operators to check the calibration status from the due date labels or records prior to using the equipment.

Measuring and testing equipment will be calibrated at prescribed intervals and/or as part of operational use. Frequency will be based on the type of equipment, inherent stability, manufacturer's recommendations, values given in national standards, intended use, and experience. Equipment will be calibrated whenever possible, using reference standards having known relationships to nationally recognized standards (e.g., National Institute of Standards and Technology) or accepted values of physical constants. If national standards do not exist, the basis for calibration will be documented.

Physical and chemical reference standards will be used only for calibration. Equipment that fails calibration or becomes inoperable during use will be removed from service and segregated to prevent inadvertent use and will be tagged to indicate the fault. Such equipment will be recalibrated and repaired to the satisfaction of the laboratory personnel or BT^2 field personnel, as applicable. Equipment that cannot be repaired will be replaced.

Records will be prepared and maintained for each piece of calibrated measuring and test equipment to document that established calibration procedures have been followed. Records for subcontractor field equipment and BT^2 equipment used only for this specific project will be kept in the project files. Laboratory calibration records will be maintained by the laboratory.

B.8 Inspection/Acceptance Requirements for Supplies & Consumables

The BT^2 Technical Coordinator will be responsible for inspecting supplies before field use. Only new sample containers accompanied by the manufacturer's certification of pre-cleaning will be used. Sample containers will be inspected for defects before use. Any sample container found to contain defects will be discarded.

The commercial laboratory will be responsible for inspecting laboratory supplies. The manufacturer's specifications for product performance and purity will be used as the acceptance criteria.

B.9 Data Acquisition Requirements for Non-direct Measurements

Soil and groundwater data have previously been collected at the WDC facility for a variety of investigation and remediation purposes. Previously collected facility data was summarized in the Final CCR (BT^2, 2005). Previously collected data include the following datasets:

- Soil and groundwater sampling results from the former chromic acid AST and dump pit area previously submitted to USEPA in support of SWMU closure (denied) and additional follow-up sampling
- Groundwater and leachate samples collected from the landfill monitoring wells and leachate piezometers in accordance with IDNR requirements
- Stormwater sampling performed in accordance with IDNR permit requirements
- RFA sampling performed by USEPA contractor
- Soil and groundwater sampling performed as part of the voluntary environmental assessment by WDC in 1998

Previously collected facility data, as well as facility data that will continue to be collected for purposes other than the RFI, will be reviewed by WDC and BT^2 personnel for use in the RFI. In evaluating data for inclusion in the RFI process, the following criteria will be considered:

- Has the data already been accepted by the regulatory agency that required its generation (USEPA, IDNR, or Iowa Department of Public Health (IDPH))?
- Was the analysis performed using methods consistent with the RFI data quality objectives?
- Were the detection limits consistent with the RFI data quality objectives?
- Were the sampling methods consistent with the RFI sampling methods? If not, data may still be usable, but comparability issues may need to be addressed and discussed.
- Are the original laboratory reports available, or only data summary tables?
- Are the results consistent with the data collected for the RFI? Older data, particularly for parameters that biodegrade, may no longer be representative of site conditions.

Assessment of the existing data will be documented in the RFI report. Existing data will be accepted, rejected, or qualified for use in the RFI decision-making process.

Non-direct measurement data will also include literature review data regarding contaminant characteristics including chemical properties (e.g., density, solubility) and migration and dispersal processes (e.g., sorption, biodegradation). These data will be tabulated from USEPA and other sources in accordance with Task III in Attachment 2 of the Order, and used in the evaluation of current and future contaminant fate and transport.

B.10 Data Management

Details regarding the data, records management, and reporting are provided in the Data Management Plan (DMP).

The raw data obtained during field activities, for example lithologic logs, pH measurements, etc., will be recorded on the appropriate field forms or in individual site logbooks. This data will become part of the project files to be maintained as described previously in this SAP/QAPP.

GROUP C: ASSESSMENT/OVERSIGHT

Performance and system audits will be completed to ensure that the field sampling activities and laboratory analyses are performed following the procedures established in this SAP/QAPP. The audits may be both internally and externally led, as further described below.

C.1 Assessments & Response Actions

C.1.1 Field Audit

The BT^2 project QA Officer will audit field activities. At least one field audit will be completed near the beginning of the sample collection activities under the investigation. If a second phase of field activities is necessary, and the second phase starts more than six months following the initial phase, then a second field audit will be completed. The field audit will include the following checklist:

Item	Description of Field Audit Task	QA Officer Initials
1.	Review of field sampling records	
2.	Review of field measurement procedures	
3.	Examination of the application of sample identifications following the specified protocol	
4.	Review of field instrument calibration records and procedures	
5.	Calibration check of field instruments to verify calibration to the manufacturer’s specifications	
6.	Review of the sample handling and packaging procedures	
7.	Review of COC procedures	

If deficiencies are observed during the audit, the deficiency will be noted in writing and a follow-up audit may be completed, if deemed necessary by the project QA Officer. Corrective action procedures may need to be implemented due to the findings from the audit. Such actions will be documented in the field logbook.

C.1.2 Laboratory Assessments

Laboratory assessments will be performed in accordance with the QA/QC procedures for TestAmerica and Matrix Environmental included in **Appendices B** and **C**.

C.2 Reports to Management

The BT^2 Project Technical Coordinator, BT^2 QA Officer, and the Laboratory QA Officer will report any significant QA problems encountered in the field or laboratory to the BT^2 Project Manager immediately by telephone.

In accordance with the Order, quarterly progress reports will be submitted to the USEPA Project Manager. These reports will include a discussion of any problems encountered during the reporting period and the actions taken to rectify the problem. The results of each field audit will be reported in the next quarterly report. At the completion of the investigation, draft and then final project reports will be issued.

GROUP D: DATA VALIDATION/USABILITY

This section describes the QA activities that will be performed to ensure that the collected data are scientifically defensible, properly documented, of known quality, and meet project objectives.

D.1 Data Review, Validation, and Verification Criteria

The following three steps will be followed to ensure that project data quality needs are met:

1. Data Verification - Data verification is a process of evaluating the completeness, correctness, and contractual compliance of a data set against the method standard, SOP, or contract requirements. Data verification will be performed internally by the entity responsible for generating the data (e.g., BT^2 for field data, TestAmerica for analytical data, Matrix for mobile laboratory data).

2. Data Validation - Data validation is an analyte- and sample-specific process that extends the qualification of data beyond method, procedural, or contractual compliance (i.e., data verification) to determine the analytical quality of specific data set. Data validation criteria are based on the measurement performance criteria of the project SAP/QAPP. Data validation will be performed by the BT^2 QA Officer.

3. Data Usability Assessment - Data usability assessment is the process of evaluating validated data to determine if the data can be used for purpose of the project (i.e., to answer the environmental questions or to make the environmental decision that must be made). Data usability will be assessed by the BT^2 Project Manager.

The BT^2 Project Manager will be responsible for resolving issues related to data verification and validation.

Criteria to be applied in the verification process include:

- Sample collection (BT^2)
    - Were the samples collected in accordance with the SAP/QAPP, SOPs or previously approved deviations?
    - Are the complete required sampling records available?
    - Were proper COC procedures followed?
- Field measurements (BT^2)
    - Were the field measurements collected in accordance with the SAP/QAPP, SOPs, or previously approved deviations?
    - Are the complete required measurement records available?
- Sample receipt (TestAmerica)
    - Were the samples received within the holding times and properly preserved?
    - Were proper COC procedures followed?
- Sample preparation and analysis (TestAmerica/Matrix)
    - Were the samples prepared and analyzed in accordance with the SAP/QAPP, approved laboratory methods, and SOPs?
    - Were all required QC samples analyzed and reported?
    - Were the sample results flagged as appropriate?

Questions to be addressed in the data validation process include:

- What data or QC deficiencies were identified in the data set as a whole through the data verification process?
- What is the impact of the deficiencies on the quality of the overall data set?
- Are additional data qualifier flags or qualification statements needed prior to use of the data?

D.2 Validation and Verification Methods

This section describes the process that will be followed to verify and validate the project data.

D.2.1 Verification

For the sample collection and field measurements, the BT^2 QA Officer will perform the verification and will report the results to the BT^2 Project Manager in a memorandum. For the sample receipt, preparation, and analysis, the TestAmerica QA Manager will perform the verification and report the results in a narrative summary attached to the laboratory report. The laboratory report will also include sample receipt information, COC records, and laboratory QC sample results including blanks, standards, matrix spikes, and matrix spike duplicates.

The BT^2 QA Officer will verify sample collection, handling, and field screening procedures as described in the SAP/QAPP and the standard procedures included in **Appendix D**.

D.2.2 Validation

The BT^2 QA Officer will perform the data validation and will report the results in a memorandum to the BT^2 Project Manager. The data validation memorandum will be forwarded to all data users following Project Manager review. Data qualifier flags will also be used to communicate data or QC deficiencies to data users.

The BT^2 QA Officer will review the data verification reports and data prepared for the field and laboratory data and will evaluate the significance of any deficiencies with respect to overall data quality and data usability for the project. Data validation will also include an assessment of field QC sample results, including blanks and duplicates.

D.3 Reconciliation with User Requirements

The validated data will be reconciled with the project use requirements by evaluating whether the sampling objectives outlined in **Section B.1** have been met and whether the data are adequate to complete the risk assessment. If the number or location of samples, or the quality of the sampling data, are not adequate to meet the objectives, then additional sampling may be required.

Anticipated statistical analysis of the data includes calculation of basic summary statistics such as the mean, range, and sample count. These will be calculated for each parameter and each medium (e.g., subsurface soil, groundwater, etc.). For parameters where the maximum result exceeds the risk-based screening level, the upper confidence limit of the mean may also be calculated as part of the risk assessment. The calculated approach for the confidence limit will be selected based on the apparent underlying distribution (normal, lognormal, other) in accordance with the procedures discussed in the Risk Assessment Guidance for Superfund-Part A.

The need for and appropriateness of additional statistical analysis will be evaluated as part of the data evaluation and risk characterization process.

TABLES

Table 1
Solid Waste Management Units and Areas of Concern
Wellman Dynamics Corporation / Sampling and Analysis Plan/Quality Assurance Project Plan

SWMU or AOC Designation	Name	Environmental Issues	RFI Status
SWMU 1	Former Wastewater Treatment Sludge Storage Area	Wastewater treatment sludge formerly stored in this area contained chromium above regulatory levels.	No further action required. USEPA certified closure of this unit in 2003.
SWMU 2	Current Wastewater Treatment Sludge Storage Area	Wastewater treatment sludge currently stored in this area contains chromium above regulatory levels and is properly managed as a hazardous waste. There is no evidence of a release to the environment from this storage area.	Limited soil sampling will be performed to confirm that there has not been a release to the environment.
SWMU 3	Spent Solvent Storage Area	A small number of drums of spent solvents, including tetrachloroethylene, were formerly stored at this location inside the main production building. There is no evidence of a release to the environment from this area and a very low potential that a release would have occurred.	No further action required.
SWMU 4	Spent Chromic Acid AST and Containment Structure	Spent chromic acid was formerly stored in this above-ground storage tank (AST). Past investigation has indicated that chromium contamination is present in the soil and groundwater in the immediate vicinity of the former AST. Contaminated soil has been excavated from this area and groundwater monitoring is ongoing.	Additional investigation will be completed to evaluate the nature, extent, and potential exposure risks associated with the chromium remaining in soil and groundwater in this area.

Table 1 (continued)
Solid Waste Management Units and Areas of Concern
Wellman Dynamics Corporation / Sampling and Analysis Plan/Quality Assurance Project Plan

SWMU or AOC Designation	Name	Environmental Issues	RFI Status
SWMU 5	Spent Chromic Acid Transfer Tank	This mobile transfer tank was formerly used to transport spent chromic acid from the process tank where it was used in the plant to the spent chromic acid AST. There is no documentation of a release for the transfer tank.	No further action required specifically for this SWMU. If a release did occur, it most likely would have occurred in the loading or unloading areas, which will be investigated under SWMUs 4 and 10.
SWMU 6	Wastewater Treatment System	The wastewater treatment system treats waste acids from the etch line prior to discharge to the city sewer system, including hydrofluoric, nitric, sulfuric, and chromic acids. There are no known releases to the soil or groundwater, but there may be a potential for a release depending on the integrity of the containment systems.	Additional investigation will be completed to determine if a past release has occurred.
SWMU 7	Waste Methanol Drum Storage Area	A small number of drums of waste methanol (spent solvent) were formerly stored in this area. There is no evidence of a past release and a limited potential that a release would have occurred. Even if a release had occurred, methanol breaks down rapidly in the environment and would not likely be present today.	Limited soil sampling will be performed to confirm that there has not been a release to the environment.

Table 1 (continued)
Solid Waste Management Units and Areas of Concern
Wellman Dynamics Corporation / Sampling and Analysis Plan/Quality Assurance Project Plan

SWMU or AOC Designation	Name	Environmental Issues	RFI Status
SWMU 8	Former Magnesium Dross Storage Area	A large number of drums of magnesium dross and magnesium-barium dross (foundry waste) were stored in this area awaiting treatment to reclaim magnesium, and spills of dross on the soil surface have been documented. Sampling during the RFA indicated that the soil contains barium and chromium. A portion of the dross storage area is regulated separately by the Iowa Department of Public Health (IDPH) due to radiological constituents.	Additional investigation will be completed to evaluate the nature and extent of contamination in soil and potentially in groundwater in this area; however, the RFI will not address the area regulated by IDPH, which is the subject of a separate investigation.
SWMU 9	Magnesium Dross Treatment Area	The magnesium dross is treated to reclaim scrap magnesium. The treatment process produces a magnesium-hydroxide sludge as the final waste product, which is disposed of in the on-site landfill under a permit from the Iowa Department of Natural Resources (IDNR). Although the treatment is generally performed within a concrete confinement area, there is some potential for a release to the environment because the containment is not complete and because untreated dross is stockpiled in the surrounding area.	Additional investigation will be completed to determine if soil and groundwater in this area have been impacted by the dross and, if so, to evaluate the extent and degree of contamination.

Table 1 (continued)
Solid Waste Management Units and Areas of Concern
Wellman Dynamics Corporation / Sampling and Analysis Plan/Quality Assurance Project Plan

SWMU or AOC Designation	Name	Environmental Issues	RFI Status
SWMU 10	Waste Acid Collection Pit	The waste acid collection pit is a concrete pit below the acid etch line in the plant. The pit collects overflow and wastewater from the process and rinse tanks. Acids collected include chromic, hydrofluoric, sulfuric, nitric, and acetic acids. There are no known releases to the environment, but the integrity of the concrete pit is not known.	Additional investigation will be completed to evaluate the potential of a release to soil and groundwater from this area.
SWMU 11	Waste Acid Dump Pit	Prior to 1971, waste acids were disposed of in the waste acid dump pit, which contained limestone intended to neutralize the acids. This area has been investigated in conjunction with SWMU 4 and it appears that both SWMUs have contributed to a merged area of chromium contamination in the soil and groundwater.	Additional investigation will be completed to evaluate the nature, extent, and potential exposure risks associated with the chromium remaining in soil and groundwater in this area.
SWMU 12	Landfill	The landfill is used for disposal of foundry sand, baghouse dust, and treated magnesium dross. A portion of the landfill area is regulated by IDPH due to former disposal of low-level radioactive thorium process sludge. The landfill is permitted and regulated by the IDNR solid waste program. Previous sampling has indicated elevated concentrations of fluoride and sulfate downgradient of the landfill.	Additional investigation will be completed to determine the nature and extent of groundwater contamination downgradient from the landfill area and to evaluate the potential risks associated with the contamination. Other issues associated with the landfill will not be included in the RFI and will continue to be regulated by the IDNR and/or IDPH.

Table 1 (continued)
Solid Waste Management Units and Areas of Concern
Wellman Dynamics Corporation / Sampling and Analysis Plan/Quality Assurance Project Plan

SWMU or AOC Designation	Name	Environmental Issues	RFI Status
AOC A	Chlorinated Solvents in Soil and Groundwater	During a 1998 voluntary environmental assessment, chlorinated solvents including tetrachloroethylene (PCE), trichloroethylene, and other chlorinated compounds were detected in soil and groundwater samples collected on-site. In one of the areas where groundwater contamination was detected, a PCE spill occurred in 1998 after the samples were collected and may have added to the solvent contamination this area.	Additional investigation will be completed to define the nature and extent of chlorinated solvent contamination in the soil and groundwater and to evaluate potential exposure pathways and risks.
AOC B	Petroleum Product AST Area	ASTs are or were used to store gasoline, diesel fuel, and kerosene in this area. Sampling as part of the 1998 voluntary environmental assessment indicated very low levels of soil contamination and did not detect petroleum contamination in groundwater.	Although the initial sampling indicated only limited contamination, some additional investigation will be completed to determine the degree and extent of petroleum contamination to soil and groundwater in this area.

SWMU = Solid Waste Management Unit
AOC = Area of Concern

Table 2
Preliminary Soil Screening Levels, Analytical Methods, and Anticipated Detection Limits
Wellman Dynamics Corporation / Quality Assurance Project Plan
(all reported concentrations are mg/kg)

	Risk-Based Screening Levels (USEPA Region 9 Preliminary Remediation Goals)			USEPA Ecological Soil Screening Level							
Contaminant	Direct Contact PRG for Residential Soil	Direct Contact PRG for Industrial Soil	Soil Screening Level for Migration to Groundwater (DAF=20)	Plants	Soil Inverte-brates	Avian Wildlife	Mammalian Wildlife	Typical Background Concentration**	TestAmerica Laboratory Proposed Method	Anticipated TestAmerica Quantification Limit	Anticipated Matrix Mobile Laboratory Reporting Limit
Metals											
Aluminum	76,000	100,000	--	--	--	--	--	64,667 [1]	SW 6010B	5.0	--
Antimony	31	410	5	--	78	--	0.27	1.0 [1]	SW 7041	2.0	--
Arsenic	0.39	1.6	29	18	--	43	46	7.3 [1]	SW 7060A	1.0	--
Barium	5,400	67,000	1,600	--	330	--	2,000	617 [1]	SW 6010B	0.50	--
Beryllium	150	1,900	63	--	40	--	21	1.3 [1]	SW 6010B	0.50	--
Boron	16,000	100,000	--	--	--	--	--	26 [2]	SW 6010B	5.0	--
Cadmium	37	450	8	32	140	0.77	0.36	--	SW 7131A	0.50	--
Calcium	--	--	--	--	--	--	--	9,200 [2]	SW 6010B	50	--
Chromium III	100,000	100,000	--	--	--	26	34	64.7 Total [1]	SW 6010B	3.0	--
Chromium VI	30	64	38	--	--	--	81		SW 7196A	3.0	--
Cobalt	900	1,900	--	13	--	120	230	11 [1]	SW 6010B	1.0	--
Copper	3,100	41,000	--	--	--	--	--	31 [1]	SW 6010B	1.0	--
Iron	23,000	10,000	--	--	--	--	--	23,278 [1]	SW 6010B	5.0	--
Lithium	1,600	20,000	--	--	--	--	--	20 [2]	SW 6010B	2.5	--
Lead	400	800	--	120	1,700	11	56	19 [1]	SW 7421	5.0	--
Magnesium	--	--	--	--	--	--	--	4,400 [2]	SW 6010B	50	--
Manganese	1,800	19,000	--	--	--	--	--	603 [1]	SW 6010B	0.5	--
Mercury	6.1*	62*	--	--	--	--	--	0.058 [2]	SW7471A	0.020	--
Molybdenum	390	5,100	--	--	--	--	--	0.59 [2]	SW 6010B	2.5	--
Nickel	1,600	20,000	130	--	--	--	--	26 [1]	SW 6010B	2.5	--
Potassium	--	--	--	--	--	--	--	15,000 [2]	SW 6010B	50	--
Selenium	390	5,100	5	--	--	--	--	0.4 [1]	SW 7740	1.0	--
Silver	390	5,100	34	--	--	--	--	--	SW 7761	1.0	--
Sodium	--	--	--	--	--	--	--	5,900 [2]	SW 6010B	50	--
Strontium	47,000	100,000	--	--	--	--	--	120 [2]	SW 6010B	5.0	--
Thallium	5.2	67	--	--	--	--	--	--	SW 7841	1.0	--
Tin	47,000	100,000	--	--	--	--	--	0.89 [2]	SW 6010B	5.0	--
Titanium	100,000	100,000	--	--	--	--	--	2,400 [2]	SW 6010B	2.5	--
Vanadium	78	1,000	6,000	--	--	7.8	280	97 [1]	SW 6010B	2.5	--
Zinc	23,000	100,000	12,000	--	--	--	--	57 [1]	SW 6010B	1.0	--

Table 2
Preliminary Soil Screening Levels, Analytical Methods, and Anticipated Detection Limits
Wellman Dynamics Corporation / Quality Assurance Project Plan
(all reported concentrations are mg/kg)

	Risk-Based Screening Levels (USEPA Region 9 Preliminary Remediation Goals)			USEPA Ecological Soil Screening Level							
Contaminant	Direct Contact PRG for Residential Soil	Direct Contact PRG for Industrial Soil	Soil Screening Level for Migration to Groundwater (DAF=20)	Plants	Soil Invertebrates	Avian Wildlife	Mammalian Wildlife	Typical Background Concentration**	TestAmerica Laboratory Proposed Method	Anticipated TestAmerica Quantification Limit	Anticipated Matrix Mobile Laboratory Reporting Limit
VOCs											
Acetone	14,000	54,000	16	--	--	--	--	--	SW 8260 B	0.05	1
Benzene	0.64	1.4	0.03	--	--	--	--	--	SW 8260 B	0.005	0.1
2-Butanone (MEK)	22,000	110,000	--	--	--	--	--	--	SW 8260 B	0.05	0.2
Carbon Disulfide	360	720	32	--	--	--	--	--	SW 8260 B	0.005	--
1,1-Dichloroethane	510	1,700	23	--	--	--	--	--	SW 8260 B	0.005	0.1
1,1-Dichloroethene	120	410	0.06	--	--	--	--	--	SW 8260 B	0.005	0.1
cis-1,2-Dichloroethene	43	150	0.4	--	--	--	--	--	SW 8260 B	0.005	0.1
trans-1,2-Dichloroethene	69	230	0.7	--	--	--	--	--	SW 8260 B	0.005	0.1
Ethylbenzene	400	400	13	--	--	--	--	--	SW 8260 B	0.005	0.2
Methylene Chloride	9.1	21	0.02	--	--	--	--	--	SW 8260 B	0.05	0.3
Tetrachloroethene	0.48	1.3	0.06	--	--	--	--	--	SW 8260 B	0.005	0.1
Toluene	520	520	12	--	--	--	--	--	SW 8260 B	0.005	0.1
1,1,1-Trichloroethane	1,200	1,200	2	--	--	--	--	--	SW 8260 B	0.005	0.1
1,1,2-Trichloroethane	0.73	1.6	0.02	--	--	--	--	--	SW 8260 B	0.005	0.2
Trichloroethene	0.053	0.11	0.06	--	--	--	--	--	SW 8260 B	0.005	0.1
Vinyl Chloride	0.079	0.75	0.01	--	--	--	--	--	SW 8260 B	0.015	0.4
Xylenes, total	270	420	210	--	--	--	--	--	SW 8260 B	0.015	0.5
PAHs											
Acenaphthene	3,700	29,000	570	--	--	--	--	--	SW 8270 C	0.33	--
Acenaphthylene	--	--	--	--	--	--	--	--	SW 8270 C	0.33	--
Anthracene	22,000	100,000	12,000	--	--	--	--	--	SW 8270 C	0.33	--
Benzo[a]anthracene	0.62	2.1	2	--	--	--	--	--	SW 8270 C	0.33	--
Benzo[b]fluoranthene	0.62	2.1	5	--	--	--	--	--	SW 8270 C	0.33	--
Benzo[k]fluoranthene	6.2	21	49	--	--	--	--	--	SW 8270 C	0.33	--
Benzo[ghi]perylene	--	--	--	--	--	--	--	--	SW 8270 C	0.33	--
Benzo[a]pyrene	0.062	0.21	8	--	--	--	--	--	SW 8270 C	0.33	--
Chrysene	62	210	160	--	--	--	--	--	SW 8270 C	0.33	--
Dibenzo[a,h]anthracene	0.062	0.21	2	--	--	--	--	--	SW 8270 C	0.33	--
Fluoranthene	2,300	22,000	4,300	--	--	--	--	--	SW 8270 C	0.33	--
Fluorene	2,700	26,000	560	--	--	--	--	--	SW 8270 C	0.33	--
Indeno[1,2,3-cd]pyrene	0.62	2.1	14	--	--	--	--	--	SW 8270 C	0.33	--
1-Methylnaphthalene	--	--	--	--	--	--	--	--	SW 8270 C	0.33	--
2-Methylnaphthalene	--	--	--	--	--	--	--	--	SW 8270 C	0.33	--
Naphthalene	56	190	84	--	--	--	--	--	SW 8270 C	0.33	--
Phenanthrene	--	--	--	--	--	--	--	--	SW 8270 C	0.33	--
Pyrene	2,300	29,000	4,200	--	--	--	--	--	SW 8270 C	0.33	--

-- = Not Applicable
mg/kg = milligrams per kilogram or parts per million (ppm)
* Mercury values for Region 9 are for methyl mercury. There are no PRGs for elemental mercury.
**PAHs are not naturally occurring in soil, therefore background concentrations for PAHs are assumed to be zero. However, PAHs can be found near populated areas at anthropogenic background concentrations due to human activities.
[1] Mean reported background concentrations for Iowa reported in Table 2.3 in the USEPA Guidance for Developing Ecological Soil Screening Levels.
[2] Background concentrations taken from US geometric mean reported in Table 2 in Elemental Concentrations in Soils and Other Surficial Materials of the Conterminous Unitied States by Shacklette and Boerngren, USGS Professional Paper 1270, 1984.
NOTE: Preliminary soil screening levels are used to select analytical methods that have adequately low detection levels. Project Preliminary Remediation Goals (PRGs) will be detemined as part of the RFI.

Table 3
Preliminary Groundwater Screening Levels, Analytical Methods, and Anticipated Detection Limits
Wellman Dynamics Corporation / Quality Assurance Project Plan

	USEPA Drinking Water Maximum Contaminant Levels (ug/l)		Risk-Based Screening Levels			
Contaminant	Primary MCL (Health-Based)	Secondary MCL (Aesthetic)	USEPA Region 9 Preliminary Remediation Goal for Tap Water (ug/l)	TestAmerica Laboratory Proposed Method	Anticipated TestAmerica Quantification Limit (ug/l)	Anticipated Matrix Mobile Laboratory Reporting Limit (ug/l)
Metals						
Antimony	6	--	15	SW 7041	6	--
Arsenic	10	--	0.045	SW 7060A	1.0	--
Barium	2,000	--	2,600	SW 6010B	20	--
Beryllium	4	--	73	SW 6010B	10	--
Boron	--	--	7,300	SW 6010B	100	--
Cadmium	5	--	18	SW 7131A	0.5	--
Chromium III	100 Total	--	55,000	SW 6010B	20	--
Chromium VI		--	110	SM 3500-Cr D	20	--
Cobalt	--	--	730	SW 6010B	20	--
Copper	1,300	1,000	1,500	SW 6010B	20	--
Lead	15	--	--	SW 7421	4	--
Mercury	2(1)	--	3.6(2)	SW 7470A	0.2	--
Nickel	--	--	730	SW 6010B	50	--
Selenium	50	--	180	SW 7740	5.0	--
Silver	--	100	180	SW 7761	20	--
Thallium	2	--	2.4	SW 7841	2	--
Tin	--	--	22,000	SW 6010B	100	--
Vanadium	--	--	36	SW 6010B	50	--
Zinc	--	5,000	11,000	SW 6010B	20	--
Other Inorganics						
Chloride	--	250,000	--	SM 4500-Cl E	5000	--
Fluoride	4,000	2,000	2,200	SM 4500-F C	200	--
Nitrite	1,000	--	1,000	SM 4500 NO3 E or EPA 354.1	100	--
Nitrate	10,000	--	10,000	SM 4500 NO3 E or EPA 353.3	100	--
Sulfate	--	250,000	--	SM 4500-SO4 E	10,000	--

Table 3
Preliminary Groundwater Screening Levels, Analytical Methods, and Anticipated Detection Limits
Wellman Dynamics Corporation / Quality Assurance Project Plan

Contaminant	USEPA Drinking Water Maximum Contaminant Levels (ug/l)		Risk-Based Screening Levels			
	Primary MCL (Health-Based)	Secondary MCL (Aesthetic)	USEPA Region 9 Preliminary Remediation Goal for Tap Water (ug/l)	TestAmerica Laboratory Proposed Method	Anticipated TestAmerica Quantification Limit (ug/l)	Anticipated Matrix Mobile Laboratory Reporting Limit (ug/l)
VOCs						
1,4-Dioxane(3)	--	--	6.1	SW 8260 B SIM	6	--
Acetone	--	--	5,500	SW 8260 B	20	10.0
Benzene	5	--	0.35	SW 8260 B	0.5	1.0
2-Butanone (MEK)	--	--	7,000	SW 8260 B	10	2.0
Carbon Disulfide	--	--	1,000	SW 8260 B	1.0	--
1,1-Dichloroethane	--	--	810	SW 8260 B	1.0	1.0
1,1-Dichloroethene	7	--	340	SW 8260 B	2.0	1.0
cis-1,2-Dichloroethene	70	--	61	SW 8260 B	1.0	1.0
trans-1,2-Dichloroethene	100	--	120	SW 8260 B	1.0	1.0
Ethylbenzene	700	--	1,300	SW 8260 B	1.0	2.0
Methylene Chloride	--	--	4.3	SW 8260 B	5.0	3.0
Naphthalene	--	--	6.2	SW 8260 B	5.0	2.0
Tetrachloroethene	5	--	0.1	SW 8260 B	5.0	1.0
Toluene	1,000	--	720	SW 8260 B	1.0	1.0
1,1,1-Trichloroethane	200	--	3,200	SW 8260 B	1.0	1.0
1,1,2-Trichloroethane	5	--	0.2	SW 8260 B	1.0	2.0
Trichloroethene	5	--	0.028	SW 8260 B	1.0	1.0
Vinyl Chloride	2	--	0.02	SW 8260 B	1.0	4.0
Xylenes, total	10,000	--	210	SW 8260 B	2.0	5.0

Table 3
Preliminary Groundwater Screening Levels, Analytical Methods, and Anticipated Detection Limits
Wellman Dynamics Corporation / Quality Assurance Project Plan

	USEPA Drinking Water Maximum Contaminant Levels (ug/l)		Risk-Based Screening Levels			
Contaminant	Primary MCL (Health-Based)	Secondary MCL (Aesthetic)	USEPA Region 9 Preliminary Remediation Goal for Tap Water (ug/l)	TestAmerica Laboratory Proposed Method	Anticipated TestAmerica Quantification Limit (ug/l)	Anticipated Matrix Mobile Laboratory Reporting Limit (ug/l)
PAHs						
Acenaphthene	--	--	370	SW 8270 C SIM	0.10	--
Acenaphthylene	--	--	--	SW 8270 C SIM	0.10	--
Anthracene	--	--	1,800	SW 8270 C SIM	0.10	--
Benzo(a)anthracene	--	--	0.092	SW 8270 C SIM	0.10	--
Benzo(b)fluoranthene	--	--	0.092	SW 8270 C SIM	0.10	--
Benzo(k)fluoranthene	--	--	0.92	SW 8270 C SIM	0.10	--
Benzo(ghi)perylene	--	--	--	SW 8270 C SIM	0.10	--
Benzo(a)pyrene	0.2	--	0.0092	SW 8270 C SIM	0.10	--
Chrysene	--	--	9.2	SW 8270 C SIM	0.10	--
Dibenzo(a,h)anthracene	--	--	0.0092	SW 8270 C SIM	0.10	--
Fluoranthene	--	--	1,500	SW 8270 C SIM	0.10	--
Fluorene	--	--	240	SW 8270 C SIM	0.10	--
Indeno(1,2,3-cd)pyrene	--	--	0.092	SW 8270 C SIM	0.10	--
Naphthalene	--	--	6.2	SW 8270 C SIM	0.10	--
Phenanthrene	--	--	--	SW 8270 C SIM	0.10	--
Pyrene	--	--	180	SW 8270 C SIM	0.10	--
SVOCs						
Phenol	--	--	11,000	SW 8270 C	10	--
2-Methylphenol	--	--	1,800	SW 8270 C	10	--
2-Methylnaphthalene	--	--	--	SW 8270 C	10	--
bis(2-Ethylhexyl)phthalate	--	--	4.8	SW 8270 C	6.9	--

ug/l = micrograms per liter or parts per billion (ppb)
-- = Not Applicable
(1) Mercury MCL is for inorganic mercury.
(2) Mercury value for Region 9 is for methyl mercury. There is no PRG for elemental mercury in tap water.
(3) Analyzed by TestAmerica Dayton, Ohio division.
NOTE: Preliminary groundwater screening levels are used to select analytical methods that have adequately low detection levels.
Project Preliminary Remediation Goals (PRGs) will be detemined as part of the RFI.

Table 4
QA Objectives for Field Measurements
Wellman Dynamics Corporation / Quality Assurance Project Plan

Parameter	Equipment[(1)]	Manufacturer's Reported Equipment Resolution	Manufacturer's Reported Equipment Accuracy	Field Use Precision Objective for Groundwater Stabilization Parameters[(2)]	Field Use Accuracy Objective[(3)]	Complete-ness Objective
WATER						
Depth to groundwater	Solinist Water Level Indicator or equivalent	0.01 ft	±0.01 ft	--	±0.01 ft.	90%
Turbidity	LaMotte Model 2020 or equivalent	0.1% of range maximum (e.g., 0.1 at 11-110 range)	±2% of reading if below 100 NTU, ±3% above 100 NTU	±5%	±5%	90%
Temperature	YSI Model 556 Multi-Probe or equivalent	0.1°C	±0.15°C	±0.2°C	±0.2°C	90%
Conductivity	YSI Model 556 Multi-Probe or equivalent	0.001 to 0.1 mS/cm	±0.5%	±1.5%	±2%	90%
Dissolved Oxygen	YSI Model 556 Multi-Probe or equivalent	0.01 mg/l	±2%	±1.5 mg/l	±1.5 mg/l	90%
Oxidation-Reduction Potential	YSI Model 556 Multi-Probe or equivalent	0.1 mV	±20 mV	±5 mV	±20 mV	90%
pH	YSI Model 556 Multi-Probe or equivalent	0.01 pH units	±0.2 pH units	±0.5 pH units	±0.2 pH units	90%
SOIL						
Field Screening for VOCs[(4)]	Thermo Environmental Model 580B Photoionization Detector	0.1 ppm as isobutylene in range 0.1-200 ppm, 1 ppm in range 200-2000 ppm	Not specified	--	approximately ± 10 % of actual concentration as isobutylene	90%

Table 4
QA Objectives for Field Measurements
Wellman Dynamics Corporation / Quality Assurance Project Plan

Parameter	Equipment(1)	Manufacturer's Reported Equipment Resolution	Manufacturer's Reported Equipment Accuracy	Field Use Precision Objective for Groundwater Stabilization Parameters(2)	Field Use Accuracy Objective(3)	Complete-ness Objective
LOCATION						
Sampling Location	Trimble GeoXT GPS with Pathfinder Pro XRS receiver or equivalent	Not specified	±0.5 meters Northing or Easting	--	±0.5 meters Northing or Easting	90%
Monitoring well top-of-casing elevations	Automatic survey level or equivalent	±0.01 ft	±0.01 ft	--	±0.01 ft.	90%
Monitoring Well Ground Surface Elevation	Automatic survey level or equivalent	±0.01 ft	±0.01 ft	--	±0.1 ft.	90%
Soil Sample Depth	Measuring tape	±0.01 ft	±0.01 ft	--	10% of sample depth for sample depth <5 ft, 0.5 ft for sample depth >4 ft	90%

NOTES:
1. Proposed equipment is shown. Alternate equipment may be substituted if it can meet the QA objectives.
2. Field precision objectives for groundwater stabilization parameters are set at approximately 50% of the stabilization criteria, so that the data are adequate to evaluate stabilization within the required stabilization range.
3. Field accuracy objectives are set based on the anticipated use of the data and the accuracy available from readily available field instruments.
4. Field screening with a PID does not provide a direct measurement of VOCs in soil and results are dependent on many factors including contaminant, soil type, ambient temperature, and soil temperature. Results should be used only as an approximate relative indication of contamination.

Table 5
Field QA/QC Sampling Requirements
Wellman Dynamics Corporation / Quality Assurance Project Plan

QA/QC Sample Type	Sample Matrix	Frequency of Sample/Analysis	Details
Equipment Rinse Blank	Water	1 per 20 investigative samples	Distilled water placed into contact with sampling equipment. Used to assess potential contaminantion associated with field sampling and decontamination procedures.
Equipment Rinse Blank	Soil - VOC Analysis	1 per 20 investigative samples	Methanol placed into contact with sampling equipment. Used to assess potential contamination associated with field sampling and decontamination precedures.
Equipment Rinse Blank	Soil - Inorganic Analysis	1 per 20 investigative samples	Distilled water placed into contact with sampling equipment. Used to assess potential contaminantion associated with field sampling and decontamination procedures.
Field Bottle Blank	Water - VOC Analysis	1 per 20 investigative samples	Laboratory reagent-grade water poured into VOC vials while sampling to assess potential contamination associated with sample containers, sampling environment, sample shipment, storage, or analysis
Trip Blank	Water - VOC Analysis	1 per sample cooler	Laboratory-prepared, organic-free blank to assess potential contamination associated with sample containers, shipment, storage, or analysis.
Methanol Blank	Soil - VOC Analysis	1 per day	A sample of methanol used to preserve soil/sediment samples for VOC analyses will be shipped each day that these samples are collected.
Duplicate Sample	All	1 per 20 investigative samples	Duplicate sample collected by the same methods and at the same time as original sample to assess verify sampling and analytical reproducibility.

Table 6
Preventive Maintenance of Field Screening Instruments
Wellman Dynamics Corporation / Quality Assurance Project Plan

Instruments	Maintenance Procedures/Schedule*	Spare Parts in Stock
Thermo Environmental Model 580B Photo-ionization Detector or equivalent	1. Calibrate beginning of each day, and as necessary during use. 2. Check battery, and recharge when low. 3. Clean lamp and dust filter in accordance with manufacturer requirements. 4. Replace water traps if they become wet.	1. Spare lamps 2. Spare dust filters 3. Spare water traps
YSI Model 556 Multi-Probe or equivalent	1. Calibrate beginning of each day, and as necessary during use. 2. Replace electrodes and membranes in accordance with manufacturer requirements.	1. pH buffers and calibration standards 2. Batteries 3. Spare electrodes and membranes
LaMotte Model 2020 Turbidity Meter or equivalent	1. Calibrate beginning of each day, and as necessary during use. 2. Replace batteries as needed.	1.Calibration standards 2. Batteries

*Specific maintenance procedures and schedules will be conducted in accordance with the manufacturer requirements for the specific instrument.

Table 7
Sample Container, Preservation, and Holding Time Requirements
Wellman Dynamics Corporation / BT^2 Project #2631

Matrix	Analysis	Container	Minimum Volume	Preservation	Holding Time
Soil / Sediment / Dross	Metals	1-4 oz widemouth glass jar	Varies	Cool to 4°C	6 months, mercury: 28 days, chromium VI: 30 days
	Volatiles	1-2 ounce widemouth glass jar plus 1-4 oz jar for % solids	25 to 35 grams	Cool to 4°, 25 mL methanol	14 days
	Semivolatiles	1-4 oz widemouth glass jar	100 grams	Cool to 4°C	14 days until extraction, 40 days after extraction
Water	Volatiles	3-40 mL septum cap vials	80 mL	HCl to pH<2, cool to 4°C	14 days
	Semivolatiles	1-1 liter amber glass bottle	1 liter	Cool to 4°C	7 days until extraction, 40 days after extraction
	Metals	1-1 liter polyethylene bottle	Varies	HNO_3 to pH<2	6 months, mercury: 28 days, **chromium VI: 24 hours**
	Sulfate	1-1 liter polyethylene bottle	100 mL	Cool to 4°C	28 days
	Nitrate+nitrite-N	1-1 liter polyethylene bottle	100 mL	Cool to 4°C, H_2SO_4 to pH<2	28 days
	Fluoride	1-1 liter polyethylene bottle	300 mL	Not applicable	28 days
	Chloride	1-1 liter polyethylene bottle	100 mL	Cool to 4°C	28 days

Table 8
Groundwater Monitoring Well Sampling Program Summary
Wellman Dynamics Corporation / Quality Assurance Project Plan

Monitoring Well Group	Appendix IX Inorganics + Cr VI			Target Anions (Cl, SO4, F, NO3)			Other Routine Landfill Parameters			Volatile Organic Compounds (VOCs)			1,4 Dioxane			Semivolatile Organic Compounds (SVOCs)			Other			Comments
	Rd 0	**Rd 1**	**Rd 2**	**Rd 0**	**Rd 1**	**Rd 2**	**Rd 0**	**Rd 1**	**Rd 2**	**Rd 0**	**Rd 1**	**Rd 2**	**Rd 0**	**Rd 1**	**Rd 2**	**Rd 0**	**Rd 1**	**Rd 2**	**Rd 0**	**Rd 1**	**Rd 2**	
Chromic Acid AST Area: MW1 -MW3, MWA	X	X	X*	X	X	X				X	X	X**		X	14D							X* = Sample only for inorganics detected above RBSLs in Rd 0 or 1 chromic acid AST source area well sampling X** = Sample for VOCs only if detected above RBSL at that well in Rd 0 or 1 14D = Sample for 1,4-dioxane only if detected at that well in Rd 1
Landfill Wells																						
Shallow Downgradient Wells: MW11, MW12, MW16, MW17	X	X	X*	X	X	X		X	X		X	X**		X	14D	X	X	X*	B	B	B*	X* = Sample only for inorganics or SVOCs detected above RBSLs in Rd 0 or 1 source area well sampling (shallow downgradient landfill wells, dross area well, or chromic acid AST wells) X** = Resample for VOCs or SVOCs only if detected above RBSL at that well in Rd 0 or 3/05 VOC sampling B* = Sample for boron only if detected in shallow downgradient wells above RBSL in Rd 0 or 1 14D = Sample for 1,4-dioxane only if detected at that well in Rd 1
Other Wells in Current Monitoring Program: MW7, MW8, MW12		X*	X*		X	X		X	X		X	X**		X	14D		X*	X**		B*	B*	
Wells Not in Current Monitoring Program: MW6, MW9, MW10, MW14, MW15, MW18		X*	X*		X	X		X			X	X**		X	14D		X*	X**		B*	B*	
Radiological Investigation Wells: MW19, MW20											X	X**		X	14D							X** and 14D = Same as for landfill wells
Dross Area Well: MW27		X	X		X	X					X	X**		X	14D							X** and 14D = Same as for landfill wells
New Property Line Wells: MW28-MW33		X*	X*		X	X		X			X	X		X	14D		X*	X**		B*	B*	X*, X**, 14D, and B* = Same as for landfill wells
New VOC Area Wells: MW34-MW40											X	X		X	14D							14D = Sample for 1,4-dioxane only if detected at that well in Rd 1

<u>ABBREVIATIONS:</u>

CrVI = Hexavalent chromium | Cl = Chloride | SO4 = Sulfate | F = Fluoride | VOCs = Volatile organic compounds
B = Boron | NO3 = Nitrate+nitrite | RBSL = Risk-based screening level | Rd = Sampling Round | AST = Above-ground storage tank

<u>NOTES</u>:
1. Round 0 is the initial source area well sampling of existing wells to identify key inorganic parameters. Rounds 1 and 2 will be coordinated with the routine semiannual landfill monitoring.
2. Other routine landfill monitoring parameters include magnesium, sodium, chemical oxygen demand, iron, ammonia, phenols, and total organic halogens.
3. All montoring well samples will also be field-tested for pH, specific conductance, temperature, turbidity, dissolved oxygen, and oxidation-reduction potential.

Table 9
Foundry Sand Metals Analysis
Wellman Dynamics Corporation / BT^2 Project #2631
(concentrations are in mg/kg)

Parameter	Foundry Sand -Dry 3/29/2005	Direct Contact PRG for Residential Soil	Direct Contact PRG for Industrial Soil	Soil Screening Level for Migration to Groundwater (DAF=20)
Antimony	<5.0	31	410	5
Arsenic	<1.0	0.39	1.6	29
Barium	3.7	5,400	67,000	1,600
Beryllium	<0.50	150	1,900	63
Boron	110	16,000	100,000	--
Cadmium	<1.0	37	450	8
Chromium	10	30 (Cr VI)	64 (Cr VI)	38 (Cr VI)
Copper	15	3,100	41,000	--
Lead	<5.0	400	800	--
Manganese	92	1,800	19,000	--
Mercury	<0.020	6.1	62	--
Molybdenum	3.1	390	5,100	--
Nickel	5.9	1,600	20,000	130
Selenium	<7.5	390	5,100	5
Silver	<1.0	390	5,100	34
Thallium	<1.0	5.2	67	--
Vanadium	<2.5	78	1,000	6,000
Zinc	14	23,000	100,000	12,000

-- = Not Applicable
mg/kg = milligrams per kilogram or parts per million (ppm)
Note: The foundry sand sample was also tested for TCLP metals. None of the eight RCRA metals were detected in the leachate.

Table 10
Landfill Leachate Monitoring Results
Wellman Dynamics Corporation - Creston, Iowa / BT2 Project #2631
(Results are in mg/l, except where otherwise noted)

Parameter	USEPA Region 9 PRG for Tap Water	Leachate Piezometer Monitoring Results								Other Leachate Samples			
		Sample S3 7/16/1992					Comp2 3/22/1996	Comp2 6/19/1996	Comp2 10/3/1996	Unfiltered 9/24/1998	Filtered 12/29/1998	Unfiltered 12/29/1998	Landfill Leachate 12/27/2005
Total Solids	--	7,200	--	--	--	--	--	--	--	7,300	2,500	7,380	9,140
Dissolved Solids	--	4,000	--	--	--	--	--	--	--	6,160	2,520	6,270	7,720
Suspended Solids	--	2,400	--	--	--	--	--	--	--	70.0	30.2	270	7.00
Alkalinity, total	--	--	--	--	--	--	--	--	--	700	597	634	644
Chloride	--	340	--	--	--	--	640	730	1,400	1,510	1,640	1,630	3,000
Fluoride	2.2	**120**	--	--	--	--	--	--	--	**83.2**	**66.5**	**66.5**	**110**
Fluoride, dissolved	2.2	--	--	--	--	--	**91**	**99**	**88**	--	--	--	--
Fluoride, distilled	2.2	--	--	--	--	--	**320**	**410**	**310**	--	--	--	--
Sulfate	--	1,100	--	--	--	--	860	**1,400**	**1,100**	**1,270**	**1,530**	**1,510**	1,070 M1
Bromide	--	1.8 (1)	--	--	--	--	--	--	--	--	--	--	--
Sulfite	--	<1	--	--	--	--	--	--	--	--	--	--	--
Sulfide	--	0.2	--	--	--	--	--	--	--	--	--	--	--
Ammonia (as N)	--	25	--	--	--	--	25	26	20	18.1	17.5	17.9	10.5
Nitrite+Nitrate (as N)	1	<0.1	--	--	--	--	--	--	--	**3.8**	<0.4	<0.4	<1.00
Phosphorous, Total	--	35	--	--	--	--	--	--	--	<0.1	<0.1	0.11	0.109
BOD	--	80 (2)	--	--	--	--	--	--	--	14.0	1.3	17.5	<12
COD	--	270	--	--	--	--	160	49	120	75.9	140	189	219
Cyanide, Total	0.73	<0.01	--	--	--	--	--	--	--	--	--	--	--
Phenols	--	0.14	--	--	--	--	--	--	--	--	--	--	--
Aluminum, Total	36	**43**	--	--	--	--	--	--	--	1.46	1.45	4.97	0.293
Antimony, Total	0.015	<0.01	--	--	--	--	--	--	--	--	--	--	--
Arsenic, Total	0.000045	<0.01	--	--	--	--	--	--	--	<0.005	<0.005	<0.005	**0.149**
Barium, Total	2.6	0.95	--	--	--	--	--	--	--	<0.02	<0.02	<0.02	0.121
Beryllium, Total	0.073	<0.02	--	--	--	--	--	--	--	--	--	--	--
Boron, Total	7.3	**260**	--	--	--	--	--	--	--	--	--	--	--
Cadmium, Total	0.018	<0.02	--	--	--	--	--	--	--	<0.01	<0.01	<0.01	<0.02
Chromium, Total	0.11	**0.11**	--	--	--	--	--	--	--	<0.01	<0.01	0.033	<0.02
Chromium, Hexavalent	0.11	<0.05	--	--	--	--	--	--	--	--	--	--	--
Cobalt, Total	0.73	<0.05	--	--	--	--	--	--	--	--	--	--	--
Copper, Total	1.5	<0.05	--	--	--	--	--	--	--	<0.02	<0.02	<0.02	0.502
Iron, Dissolved	11	--	--	--	--	--	--	--	**70**	**25.6**	**16.9**	**71.9**	1.99
Iron, Total	11	**120**	--	--	--	--	**320**	**110**	--	--	--	--	--
Lead, Total	--	<0.1	--	--	--	--	--	--	--	<0.005	<0.005	<0.005	0.136
Magnesium, Dissolved	--	--	--	--	--	--	300	470	520	598	708	399	798
Magnesium, Total	--	300	--	--	--	--	370	410	460	--	--	--	--
Manganese, total	0.88	**6.0**	--	--	--	--	--	--	--	**8.3**	**8.07**	**5.85**	**7.89**
Mercury, Total	--	<0.001	--	--	--	--	--	--	--	<0.0002	<0.0002	<0.0002	<0.0002
Nickel, Total	0.73	0.14	--	--	--	--	--	--	--	<0.02	<0.02	0.03	0.0529
Potassium	--	--	--	--	--	--	--	--	--	600	1,140	661	821

Table 10
Landfill Leachate Monitoring Results
Wellman Dynamics Corporation - Creston, Iowa / BT2 Project #2631
(Results are in mg/l, except where otherwise noted)

Parameter	USEPA Region 9 PRG for Tap Water	Leachate Piezometer Monitoring Results								Other Leachate Samples			
		Sample S3 7/16/1992					Comp2 3/22/1996	Comp2 6/19/1996	Comp2 10/3/1996	Unfiltered 9/24/1998	Filtered 12/29/1998	Unfiltered 12/29/1998	Landfill Leachate 12/27/2005
Selenium, Total	0.18	<0.01	--	--	--	--	--	--	--	<0.005	<0.01	<0.01	**0.508**
Silver, Total	0.18	0.01	--	--	--	--	--	--	--	<0.01	<0.01	<0.01	<0.02
Sodium, Dissolved	--	--	--	--	--	--	83	110	250	--	--	--	--
Sodium, Total	--	--	--	--	--	--	110	93	230	--	--	--	--
Thallium, Total	0.0024	<0.001	--	--	--	--	--	--	--	--	--	--	--
Tin, Total	22	<0.5	--	--	--	--	--	--	--	--	--	--	--
Zinc, Total	11	0.97	--	--	--	--	--	--	--	0.239	<0.02	1.42	0.490
GC/MS Extractables (semivolatiles)(ug/l)													
Phenol	11000	<4	--	--	--	--	--	--	--	28	--	75	<10.0
2-Methylphenol	--	<10	--	--	--	--	--	--	--	23.1	--	54.8	<10.0
Naphthalene	6.2	<4	--	--	--	--	--	--	--	**217**	--	**527**	<10.0
2-Methylnaphthalene	--	<4	--	--	--	--	--	--	--	<10	--	17.9	<10.0
Bis(2-ethylhexyl)phthalate	4.8	<10	--	--	--	--	--	--	--	**23.2**	--	<10	<10.0
Other SVOCs	--	ND	--	--	--	--	--	--	--	ND	--	ND	ND
Herbicides, Pesticides, and PCBs	--	ND	--	--	--	--	--	--	--	ND	--	--	ND
VOCs (ug/l)													
1,1-Dichloroethane	810	60	58	61	58	69	--	--	--	54.1	--	36.4	14.7
cis 1,2-Dichloroethene	61	14	14	15	15	16	--	--	--	<10.0	--	<5	7.34
1,1,1-Trichloroethane	3200	54	54	61	55	37	--	--	--	<10.0	--	<5	<1
Vinyl Chloride	0.02	<5	<5	<5	<5	<5	--	--	--	<10.0	--	<5	**5.06**
Benzene	0.35	<5	<5	<5	<5	<5	--	--	--	<10.0	--	<5	**0.610**
Toluene	720	<5	<5	<5	6	<5	--	--	--	210	--	35.8	--
Acetone	5500	40	44	39	45	49	--	--	--	<50.0	--	<15	<10.0
2-Butanone	7000	21	20	18	11	23	--	--	--	<10.0	--	<5	<10.0
Xylenes, Total	210	19	23	20	25	23	--	--	--	11.2	--	<5	2.53
Other VOCs	--	ND	ND	ND	ND	ND	--	--	--	ND	--	ND	ND

ABBREVIATIONS:

mg/l = milligrams per liter or parts per million (ppm)
-- = Not analyzed
BOD = biological oxygen demand
VOCs = volatile organic compounds

ug/l = micrograms per liter or parts per billion (ppb)
ND = None detected
COD = chemical oxygen demand
Bold indicates result exceeds PRG

NOTES:

1. Data compiled from laboratory reports in Final Groundwater Quality Assessment Report prepared by Howard R. Green Company, March 1997, and individual laboratory reports provided by WDC.
2. Leachate piezometer samples are composites, except for VOC results believed to be from individual leachate piezometers.
3. "Other Leachate Samples" may have been collected from the leachate sewer discharge monitoring point or from other locations in the leachate collection system.

LABORATORY NOTES:

1. Due to chloride interference, bromide was analyzed on a diluted portion of the original sample.
2. BOD missed and reset. Value may be low.

M1 = The MS and/or MSD were outside control limits.

Created by: SCC 5/20/04 Revised by: LH 4/14/06
Checked by: SMS 5/20/04 Checked by: SCC 4/17/06

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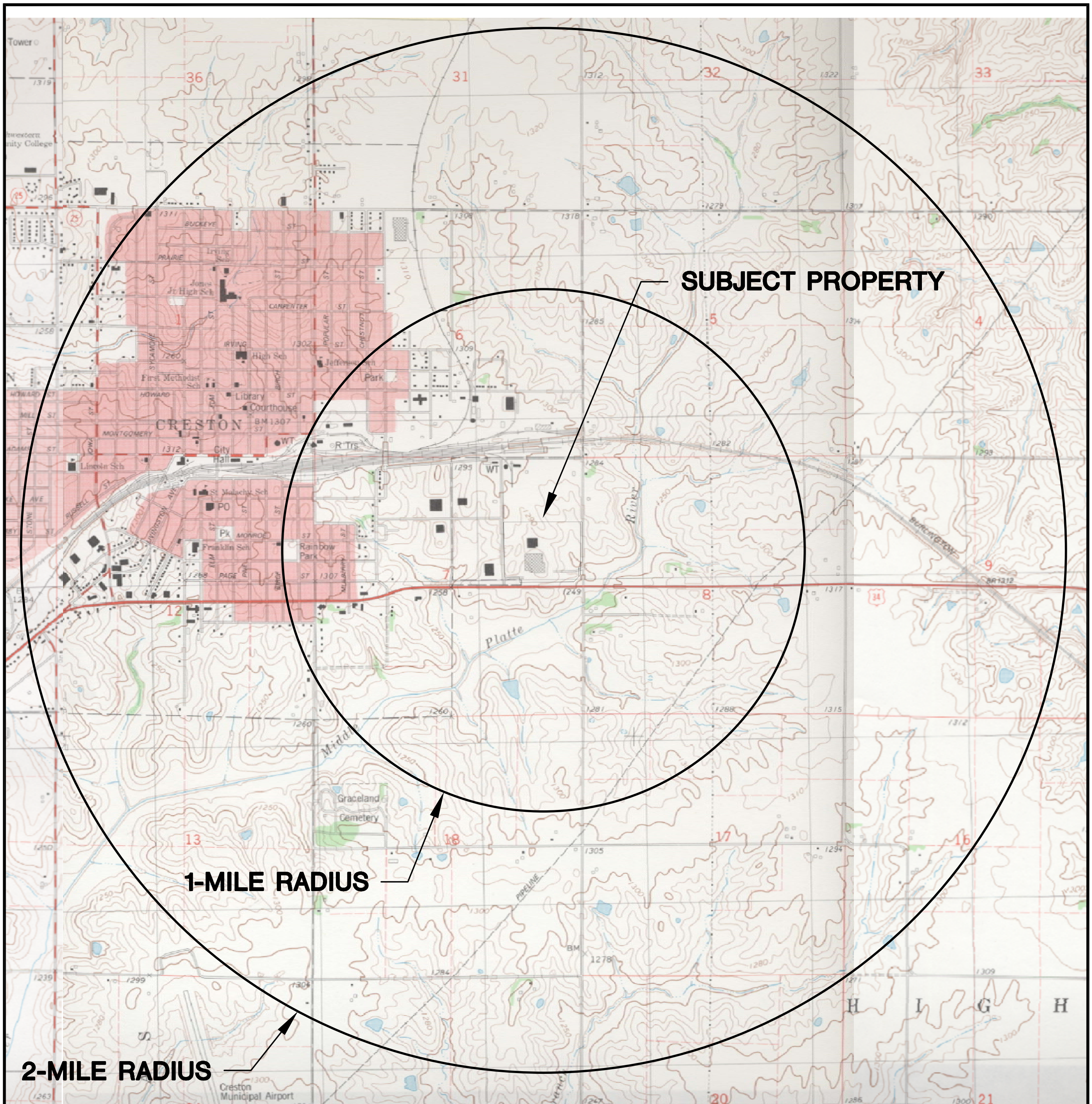
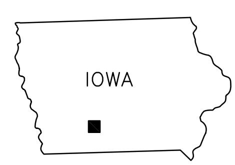
FIGURES



N

CRESTON EAST QUADRANGLE
IOWA
7.5 MINUTE SERIES (TOPOGRAPHIC)

SCALE: 1" = 3,000'



PROJECT NO. 2631	FIGURE 1 SITE LOCATION MAP RCRA FACILITY INVESTIGATION WORKPLAN WELLMAN DYNAMICS CORPORATION CRESTON, IOWA
DRAWN BY: KP	
CHECKED BY: SC	
APPROVED BY: SC	
DRAWN: 02/09/04	
REVISED: 05/20/04	

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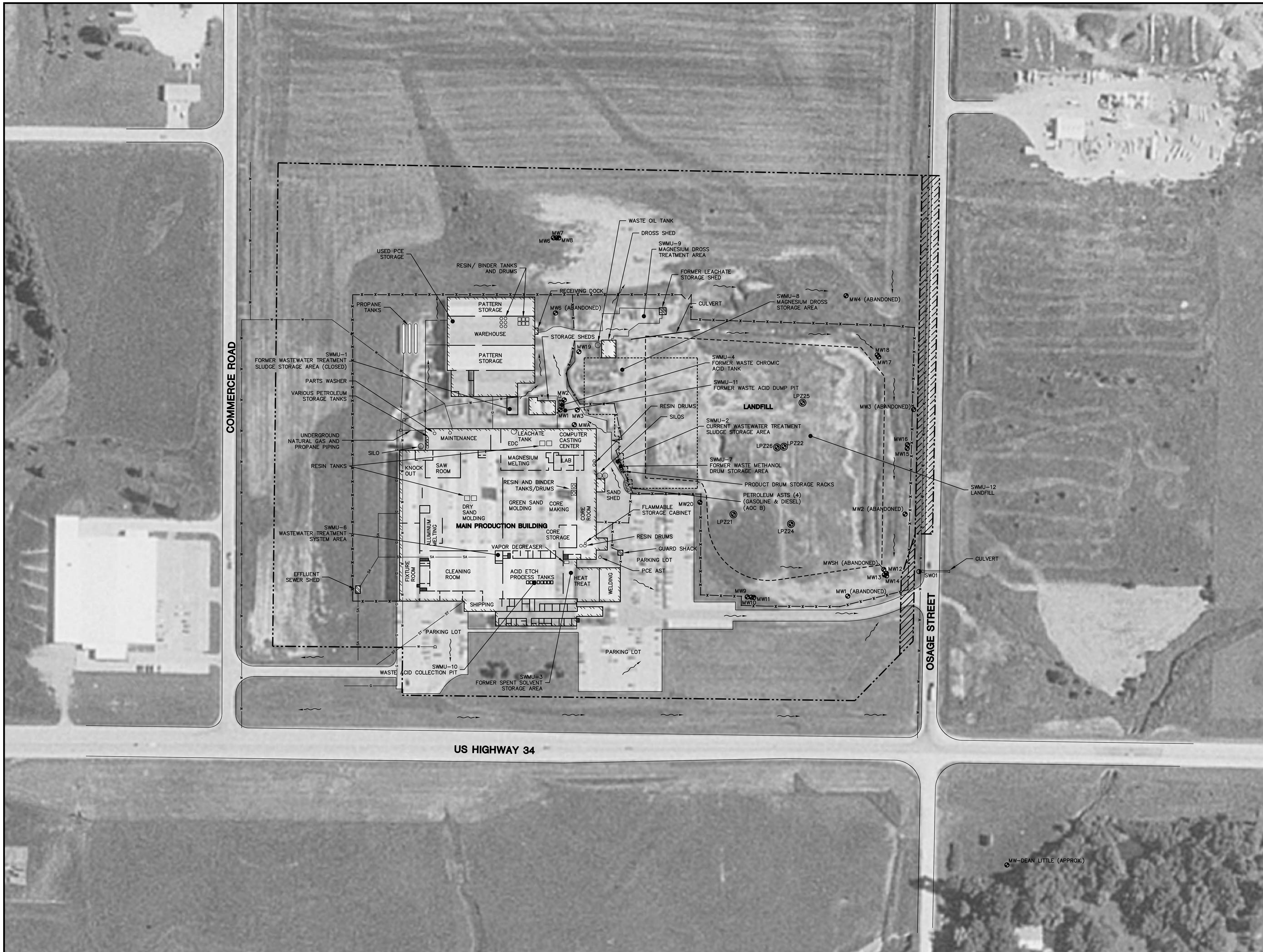

LEGEND

MW12	MONITORING WELL
LPZ24	LEACHATE PIEZOMETER
SW01	SURFACE WATER MONITORING POINT
	APPROXIMATE LANDFILL BOUNDARY
	APPROXIMATE RADIOLOGICAL INVESTIGATION AREA BOUNDARY
	APPROXIMATE PROPERTY LINE
	FACILITY PROPERTY WITH GRANTED EASEMENT
—x—x—x—	FENCE
—G—	GAS MAIN
—P—	ABOVEGROUND PROPANE PIPING
—SA—	SANITARY SEWER
—ST—	STORM SEWER
—W—	WATER MAIN
	HYDRANT
	SURFACE DRAINAGE
SWMU	SOLID WASTE MANAGEMENT UNIT (NOTE: SWMU 5 NOT SHOWN BECAUSE IT IS A FORMER PORTABLE TANK)
AOC	AREA OF CONCERN (NOTE: AOC A IS NOT IDENTIFIED AS A SPECIFIC POINT BECAUSE IT INCLUDES SEVERAL LOCATIONS OF VOC GROUNDWATER CONTAMINATION EAST AND NORTH OF THE MAIN BUILDING, SEE FIGURES 5 AND 6)

NOTES:

1. BASE MAP SOURCE IS 3.75 MINUTE DIGITAL ORTHOPHOTO QUAD, CRESTON EAST, SW, USGS. DATE OF IMAGE IS JULY 28, 1995.
2. PROPERTY LINE AND EASEMENT INFORMATION IS FROM CORPORATE WARRANTY DEED DATED JUNE 20, 1985, DOC #2115 BOOK 436 P.30-31, UNION COUNTY, AND FROM CORPORATE WARRANTY DEED DATED FEBRUARY 23, 1971.
3. INTERIOR BUILDING FEATURES ARE FROM TIER TWO EMERGENCY AND HAZARDOUS CHEMICAL INVENTORY, REPORTING PERIOD FROM JANUARY 1 TO DECEMBER 31, 2003.
4. SURFACE DRAINAGE INFORMATION IS FROM INDIVIDUAL STORM WATER DISCHARGE PERMIT APPLICATION, AUGUST 13, 2002.
5. LANDFILL BOUNDARY FROM CURRENT SITE MAP PREPARED BY BARKER LEMAR ENGINEERING CONSULTANTS, MARCH 10, 2004.
6. RADIOLOGICAL INVESTIGATION AREA FROM SITE CHARACTERIZATION SURVEY REPORT, SEPTEMBER 2003, EARTH SCIENCES CONSULTANTS, INC.
7. WELL LOCATIONS ARE FROM SITE TOPOGRAPHIC AND WELL LOCATION MAP, MAY 1992, GREEN ENVIRONMENTAL SERVICES, INC.
8. UTILITY LOCATIONS ARE FROM PLANS PROVIDED BY FWD. ALL UTILITY LOCATIONS ARE APPROXIMATE AND HAVE NOT BEEN FIELD VERIFIED.

100 0 100

SCALE: 1" = 100'

SITE PLAN

CURRENT CONDITIONS REPORT
FANSTEEL/WELLMAN DYNAMICS CORPORATION
CRESTON, IOWA

PROJECT NO. 2631
DRAWN BY: KP
CHECKED BY: SMS
APPROVED BY:
DRAWN: 03/24/04
REVISED: 05/14/04

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FIGURE 2

Figure 3
Potential Exposure Pathway Summary
Sampling and Analysis Plan / Quality Assurance Project Plan
Wellman Dynamics, Creston, Iowa

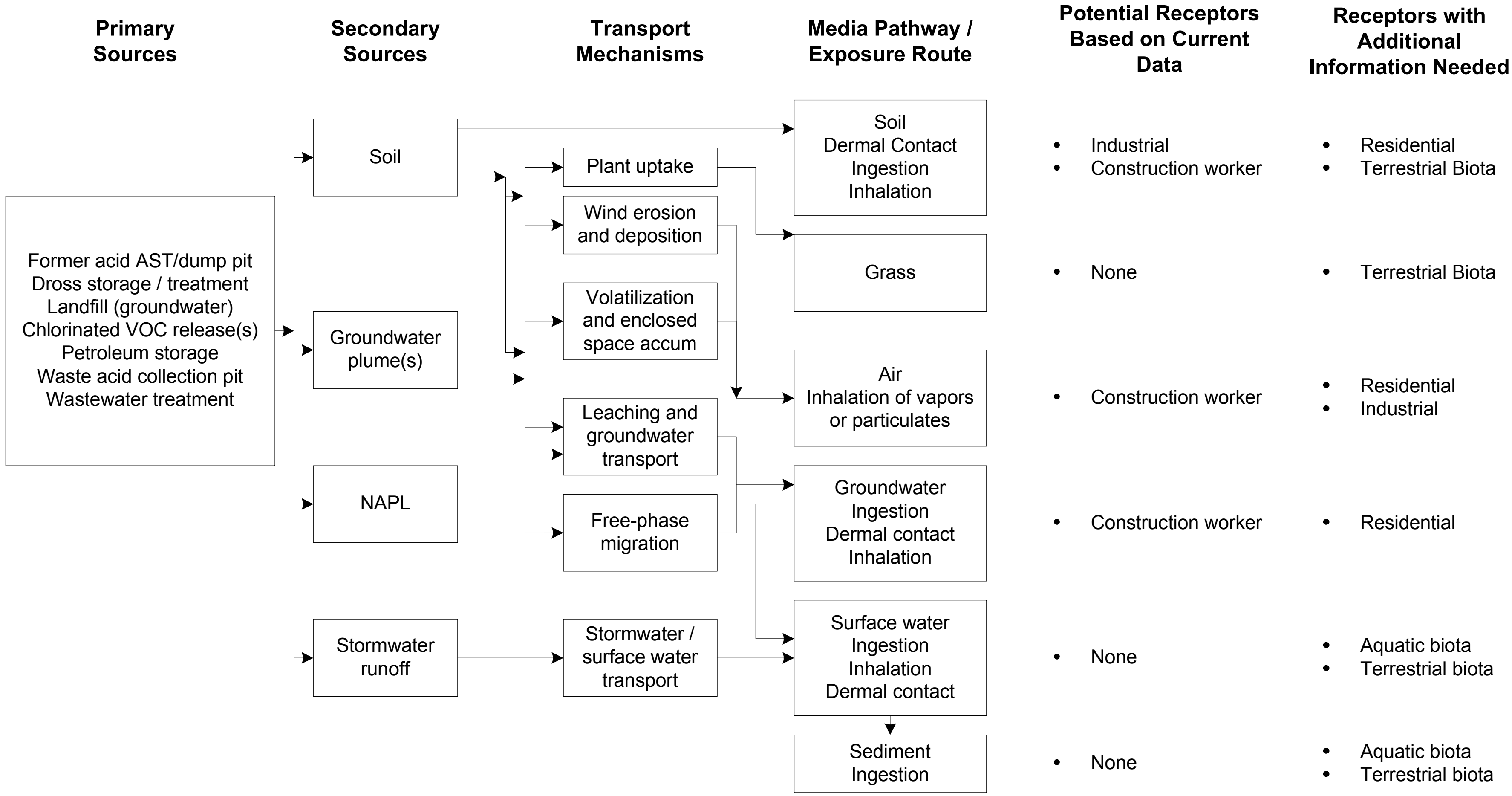
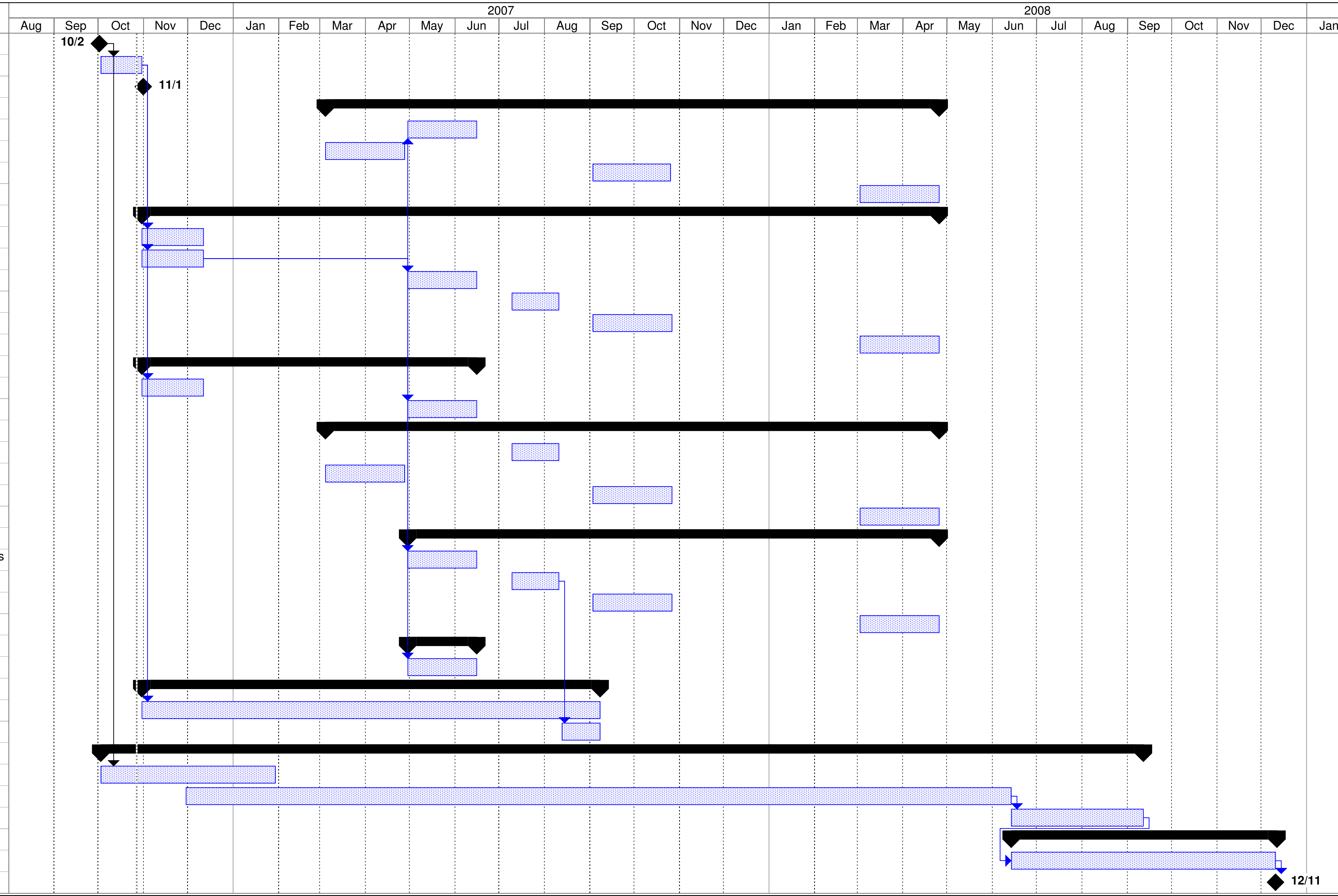


Figure 4
Proposed Project Schedule
RCRA Facility Investigation Workplan
Wellman Dynamics Corporation

ID	Task Name
1	RFI Workplan Approval Received by WDC
2	Planning and contracting
3	Final RFI Workplan to USEPA
4	**Chromic Acid AST/Dump Pit sampling**
5	Geoprobe soil sampling and analysis
6	Groundwater sampling and analysis - Round 0
7	Groundwater sampling and analysis - Round 1
8	Groundwater sampling and analysis - Round 2
9	**Magnesium Dross Storage/Treatment Area**
10	Dross sampling and analysis
11	Surface soil sampling and analysis
12	Geoprobe sampling and analysis, if needed
13	Monitoring well installation
14	Groundwater sampling and analysis - Round 1
15	Groundwater sampling and analysis - Round 2
16	**Current Wastewater Treatment Sludge Storage Area**
17	Surface soil sampling
18	Geoprobe sampling, if needed
19	**Landfill Groundwater Impacts Evaluation**
20	Monitoring Well Installation
21	Groundwater sampling and analysis - Round 0
22	Groundwater sampling and analysis - Round 1
23	Groundwater sampling and analysis - Round 2
24	**VOC Investigation**
25	Geoprobe soil and groundwater sampling and analysis
26	Monitoring well installation
27	Groundwater sampling and analysis - Round 1
28	Groundwater sampling and analysis - Round 2
29	**Waste Acid Collection Pit and WWTS Investigation**
30	Geoprobe sampling and analysis
31	**Geologic and Hydrogeologic Characterization**
32	Soil logging and testing
33	Slug tests
34	**Data Analysis**
35	Existing data review and validation
36	New data review and validation
37	Risk Assessment
38	**RFI Report**
39	Draft RFI Report
40	Draft RFI Report to USEPA



Project: 2631_ProjSchedule_060929_
Date: Fri 10/27/06

Task		Progress		Summary		External Tasks		Deadline	
Split		Milestone		Project Summary		External Milestone			

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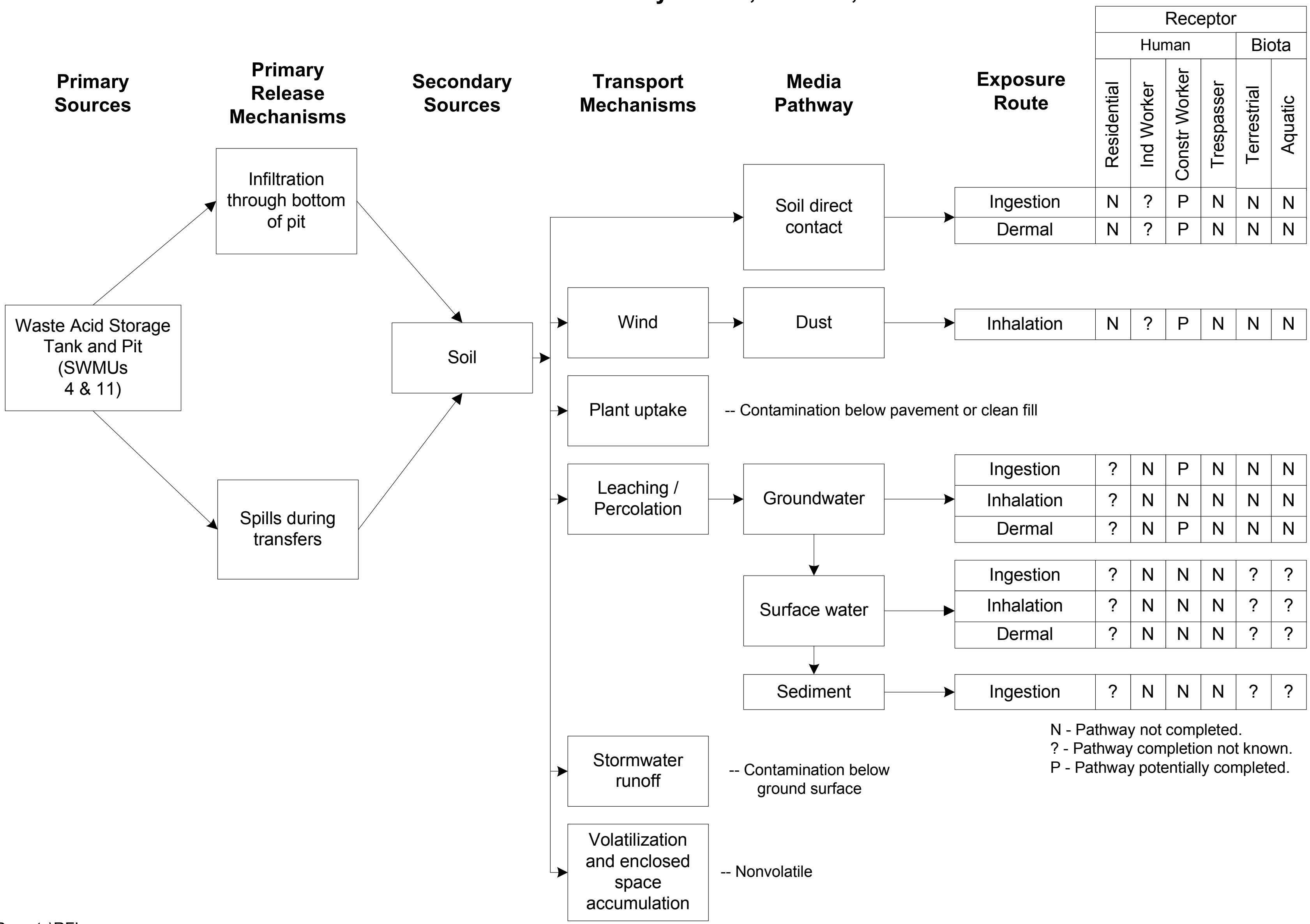
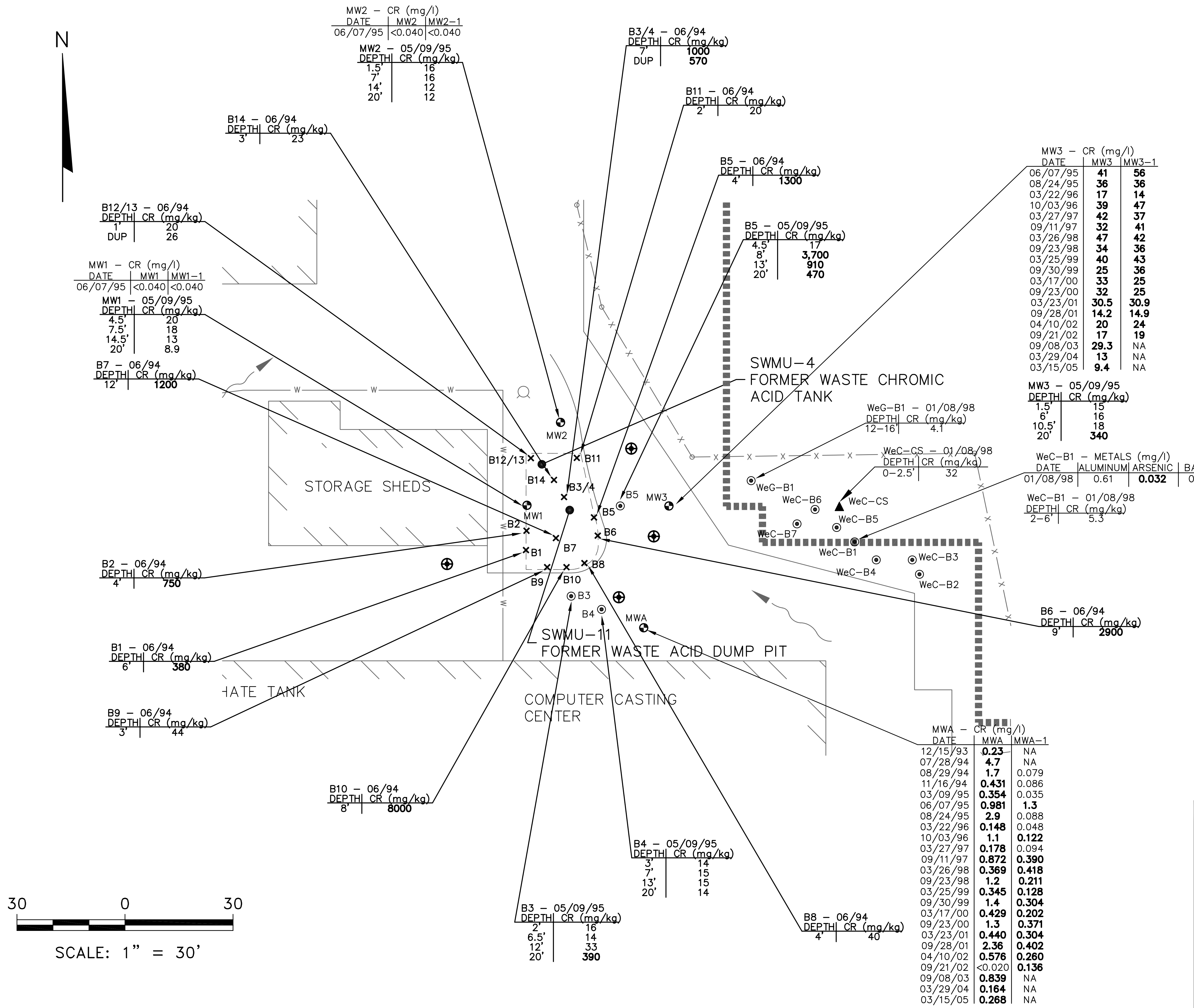
Figure 5
Exposure Pathway Evaluation
Former Chromic Acid AST and Dump Pit Area (SWMUs 4 & 11)
Sampling and Analysis Plan / Quality Assurance Project Plan
Wellman Dynamics, Creston, Iowa





LEGEND

- APPROXIMATE RADIOLOGICAL INVESTIGATION AREA BOUNDARY
- GEOPROBE BORING
- MONITORING WELL
- APPROXIMATE LIMITS OF EXCAVATION
- EXCAVATION SOIL SAMPLE
- SURFACE COMPOSITE SAMPLE
- PROPOSED GEOPROBE BORING

NOTES:

1. BOLD SOIL RESULT INDICATES VALUE IS ABOVE USEPA REGION 9 PRELIMINARY REMEDIATION GOAL FOR INDUSTRIAL DIRECT CONTACT (64 mg/kg).
2. BOLD GROUNDWATER RESULT INDICATES VALUE IS ABOVE MCL.
3. SOIL DATA TAKEN FROM DECEMBER 1994 CLOSURE CERTIFICATION REPORT AND JUNE 22, 1995 SOIL BORINGS/MONITORING WELLS RESULTS LETTER, BOTH PREPARED BY H.R. GREEN CO. AND FROM ANTECH, LTD. LABORATORY REPORT DATED JANUARY 29, 1999.
4. GROUNDWATER DATA COMPILED FROM LABORATORY REPORTS AND CORRESPONDENCE BETWEEN GREEN ENVIRONMENTAL SERVICES, INC. AND FANSTEEL/WELLMAN DYNAMICS PERSONNEL.

FIGURE 6
SAMPLING PLAN – FORMER CHROMIC ACID AST AND DUMP PIT AREA
RCRA FACILITY INVESTIGATION WORKPLAN
WELLMAN DYNAMICS CORPORATION
CRESTON, IOWA

PROJECT NO. 2631
DRAWN BY: KP
CHECKED BY: SC
APPROVED BY: SC
DRAWN: 8/15/05
REVISED: 09/08/05

BT² inc.

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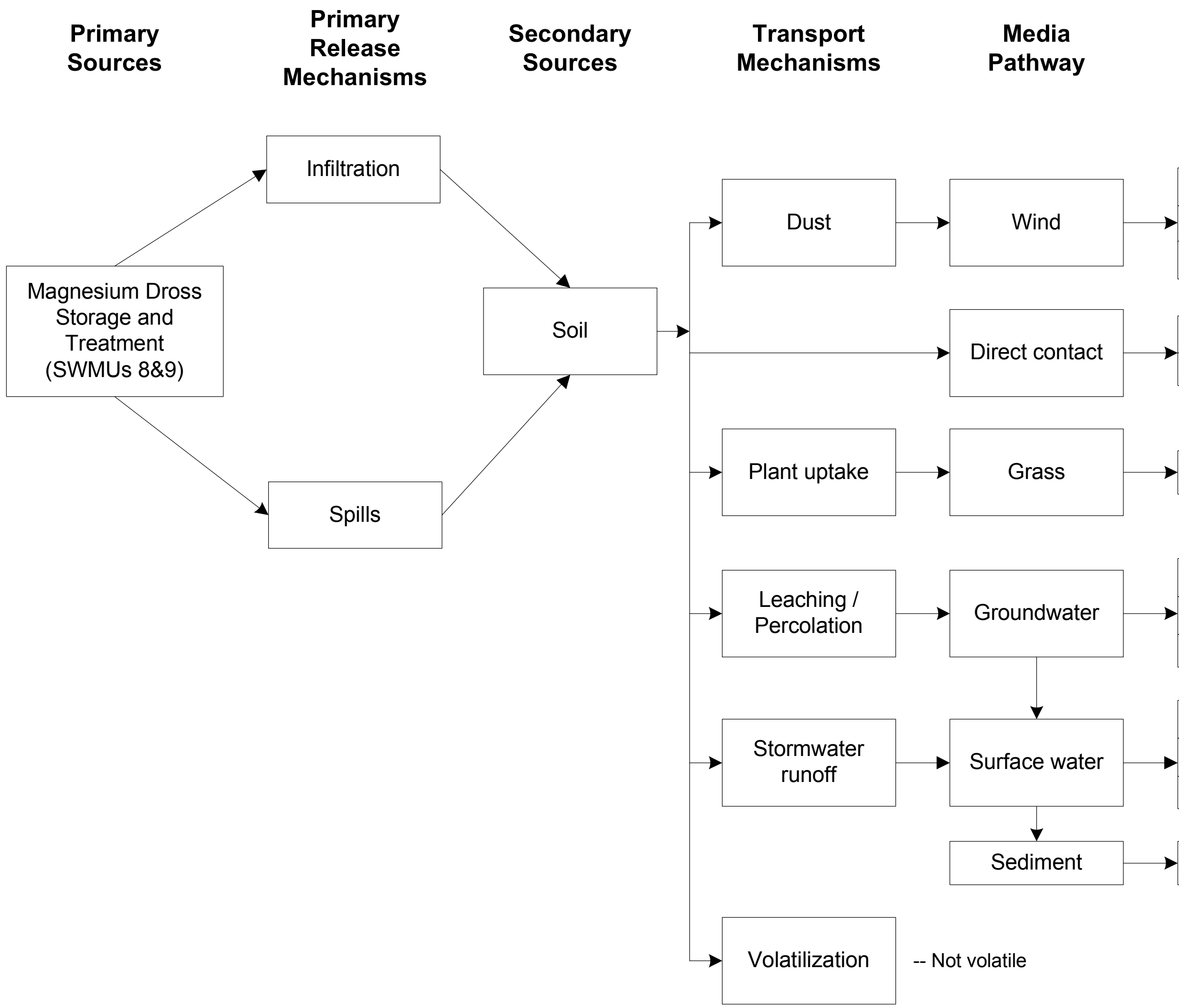
Figure 7
Exposure Pathway Evaluation
Magnesium Dross Storage and Treatment Area (SWMUs 8 & 9)
Sampling and Analysis Plan / Quality Assurance Project Plan
Wellman Dynamics, Creston, Iowa

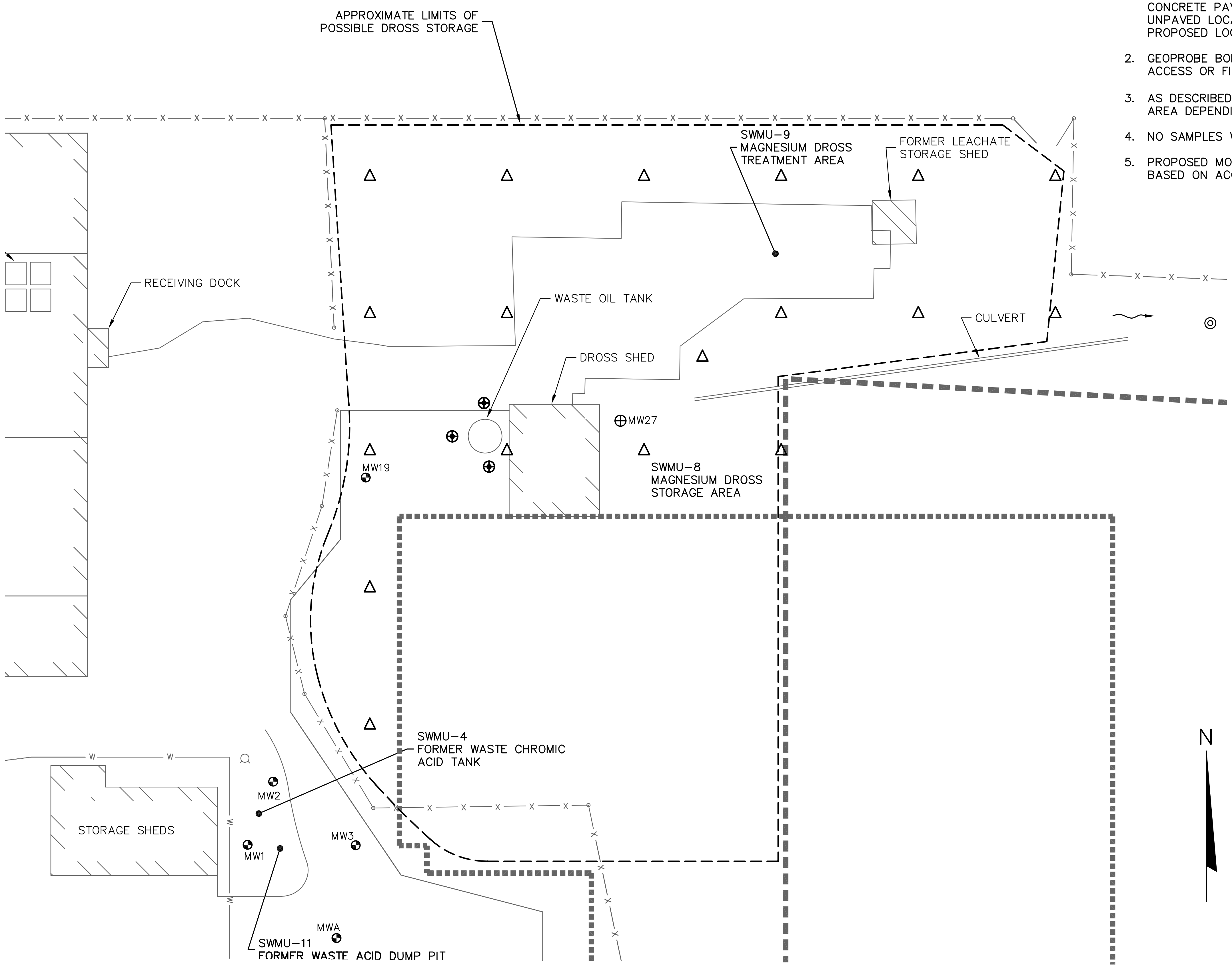


Media Pathway	Exposure Route	Current – Human: Residential	Ind Worker	Constr Worker	Trespasser	Current – Biota: Terrestrial	Aquatic
Wind	Ingestion	N	P	P	N	?	N
	Inhalation	N	P	P	N	?	N
	Dermal	N	P	P	N	?	N
Direct contact	Ingestion	N	P	P	N	?	N
	Dermal	N	P	P	N	?	N
Grass	Ingestion	N	N	N	N	?	N
Groundwater	Ingestion	?	N	?	N	N	N
	Inhalation	?	N	N	N	N	N
	Dermal	?	N	?	N	N	N
Surface water	Ingestion	?	N	N	N	?	?
	Inhalation	?	N	N	N	?	?
	Dermal	?	N	N	N	?	?
Sediment	Ingestion	?	N	N	N	?	?

N - Pathway not completed.
? - Pathway completion not known.
P - Pathway potentially completed.

NOTES:

1. SURFACE SOIL SAMPLING LOCATIONS ARE APPROXIMATE AND MAY BE MODIFIED BASED ON ACCESS. IF A PROPOSED SAMPLING LOCATION IS IN AREA OF ASPHALT OR CONCRETE PAVING, THEN THE SAMPLE WILL BE COLLECTED FROM THE CLOSEST UNPAVED LOCATION THAT MAY RECEIVE STORMWATER RUNOFF FROM THE INITIAL PROPOSED LOCATION.
2. GEOPROBE BORING LOCATIONS AROUND USED OIL AST MAY BE MODIFIED BASED ON ACCESS OR FIELD OBSERVATIONS INDICATING A POSSIBLE RELEASE.
3. AS DESCRIBED IN THE SAP/QAPP, GEOPROBE BORINGS MAY BE INSTALLED IN THIS AREA DEPENDING ON THE SURFACE SOIL SAMPLING RESULTS.
4. NO SAMPLES WILL BE COLLECTED WITHIN THE RADIOLOGICAL INVESTIGATION AREA.
5. PROPOSED MONITORING WELL LOCATION IS APPROXIMATE AND WILL BE ADJUSTED BASED ON ACCESS AND FIELD CONDITIONS.



LEGEND

- APPROXIMATE LANDFILL BOUNDARY
- APPROXIMATE RADIOLOGICAL INVESTIGATION AREA BOUNDARY
- EXISTING MONITORING WELL
- PROPOSED SURFACE SOIL SAMPLE
- PROPOSED GEOPROBE BORING
- SURFACE WATER AND SEDIMENT SAMPLE LOCATION
- SURFACE DRAINAGE
- PROPOSED WATER TABLE MONITORING WELL

40 0 40

SCALE: 1" = 40'

FIGURE 8
SAMPLING PLAN – MAGNESIUM DROSS
STORAGE AND TREATMENT AREA
RCRA FACILITY INVESTIGATION WORKPLAN
WELLMAN DYNAMICS CORPORATION
CRESTON, IOWA

PROJECT NO. 2631
DRAWN BY: KP
CHECKED BY: SC
APPROVED BY: SC
DRAWN: 08/15/05
REVISED: 04/21/06

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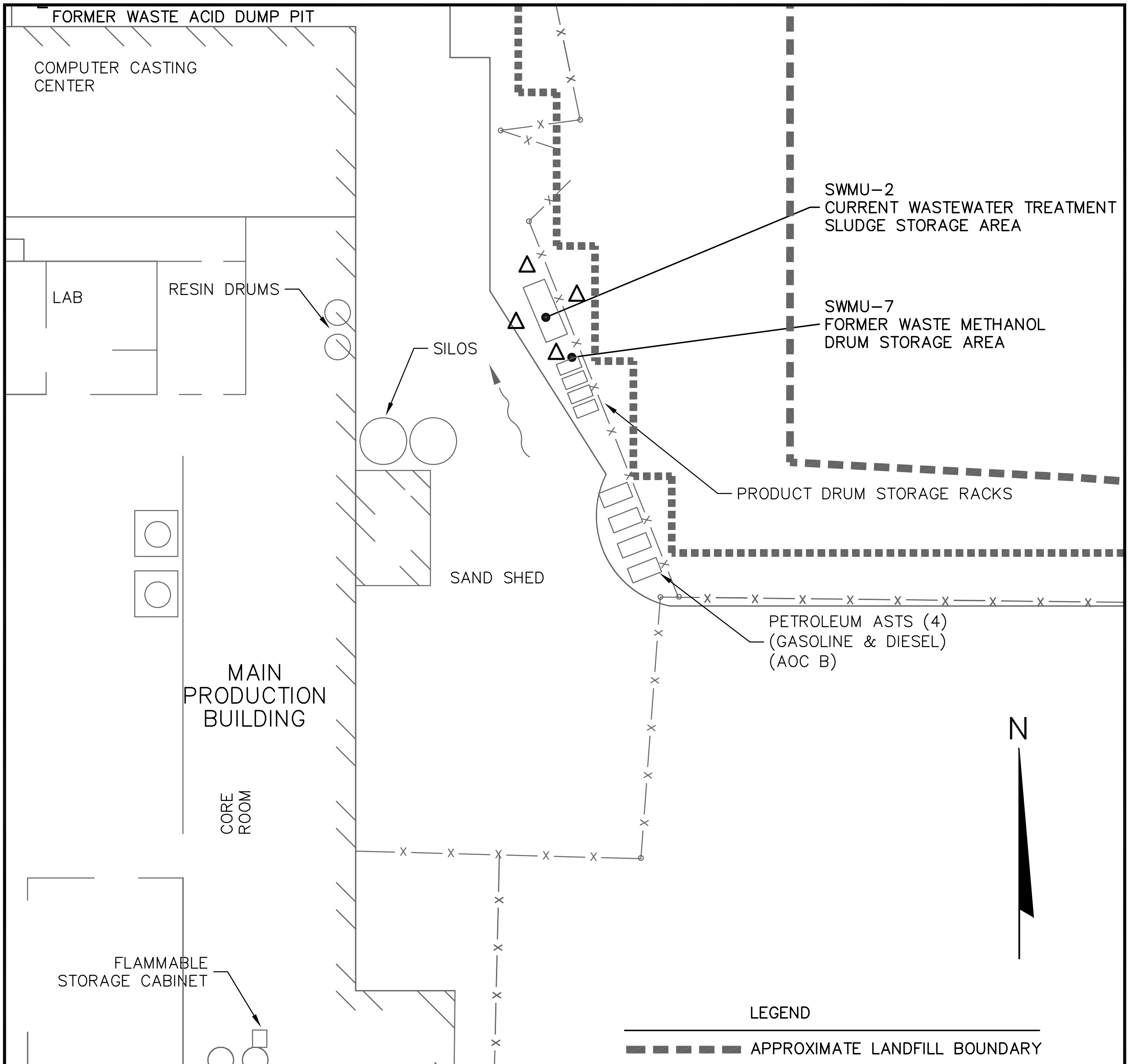

LEGEND

APPROXIMATE LANDFILL BOUNDARY

APPROXIMATE RADIOLOGICAL INVESTIGATION AREA BOUNDARY

△ PROPOSED SURFACE SOIL SAMPLE

NOTES:

1. SURFACE SOIL SAMPLING LOCATIONS ARE APPROXIMATE AND MAY BE ADJUSTED BASED ON ACCESS OR FIELD OBSERVATIONS INDICATING A POTENTIAL RELEASE AREA.

2. IF ANY OF THE PROPOSED SAMPLING LOCATIONS ARE IN PAVED AREAS, THE SAMPLE WILL INSTEAD BE COLLECTED FROM THE NEAREST UNPAVED AREA LIKELY TO RECEIVE STORMWATER RUNOFF FROM THE INITIAL PROPOSED SAMPLING LOCATION.

40 0 40

SCALE: 1" = 40'

PROJECT NO. 2631	FIGURE 9 SAMPLING PLAN – CURRENT WASTEWATER TREATMENT SLUDGE STORAGE AREA RCRA FACILITY INVESTIGATION WORKPLAN WELLMAN DYNAMICS CORPORATION CRESTON, IOWA
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CHECKED BY: SC	
APPROVED BY: SC	
DRAWN: 8/15/05	
REVISED: 8/23/05	

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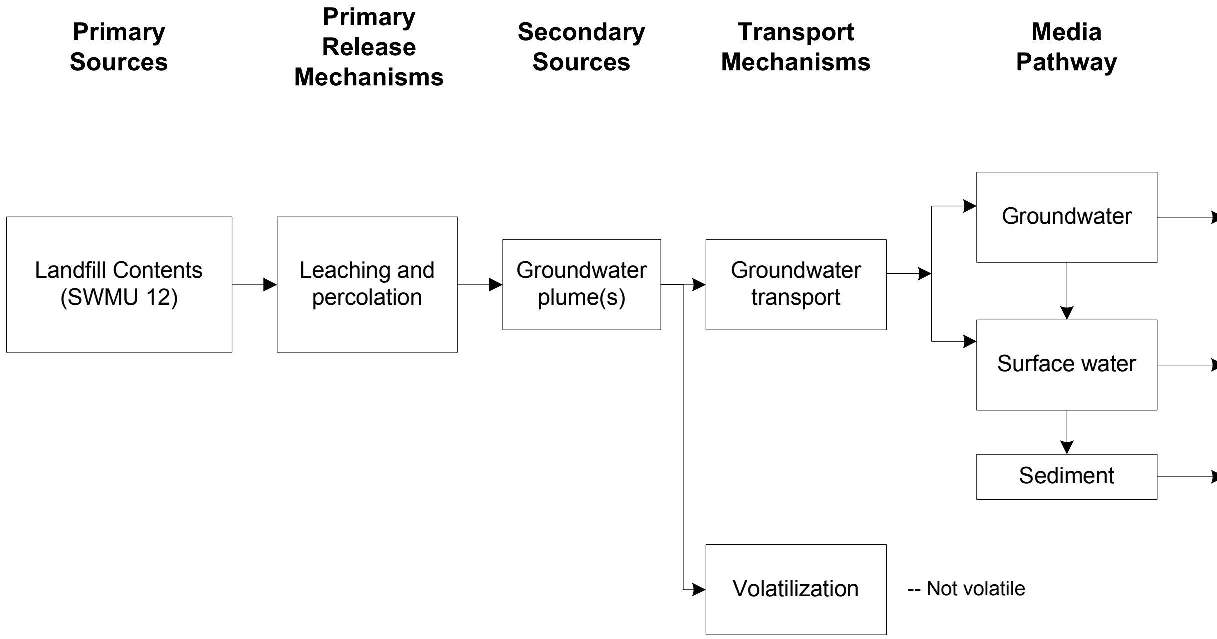
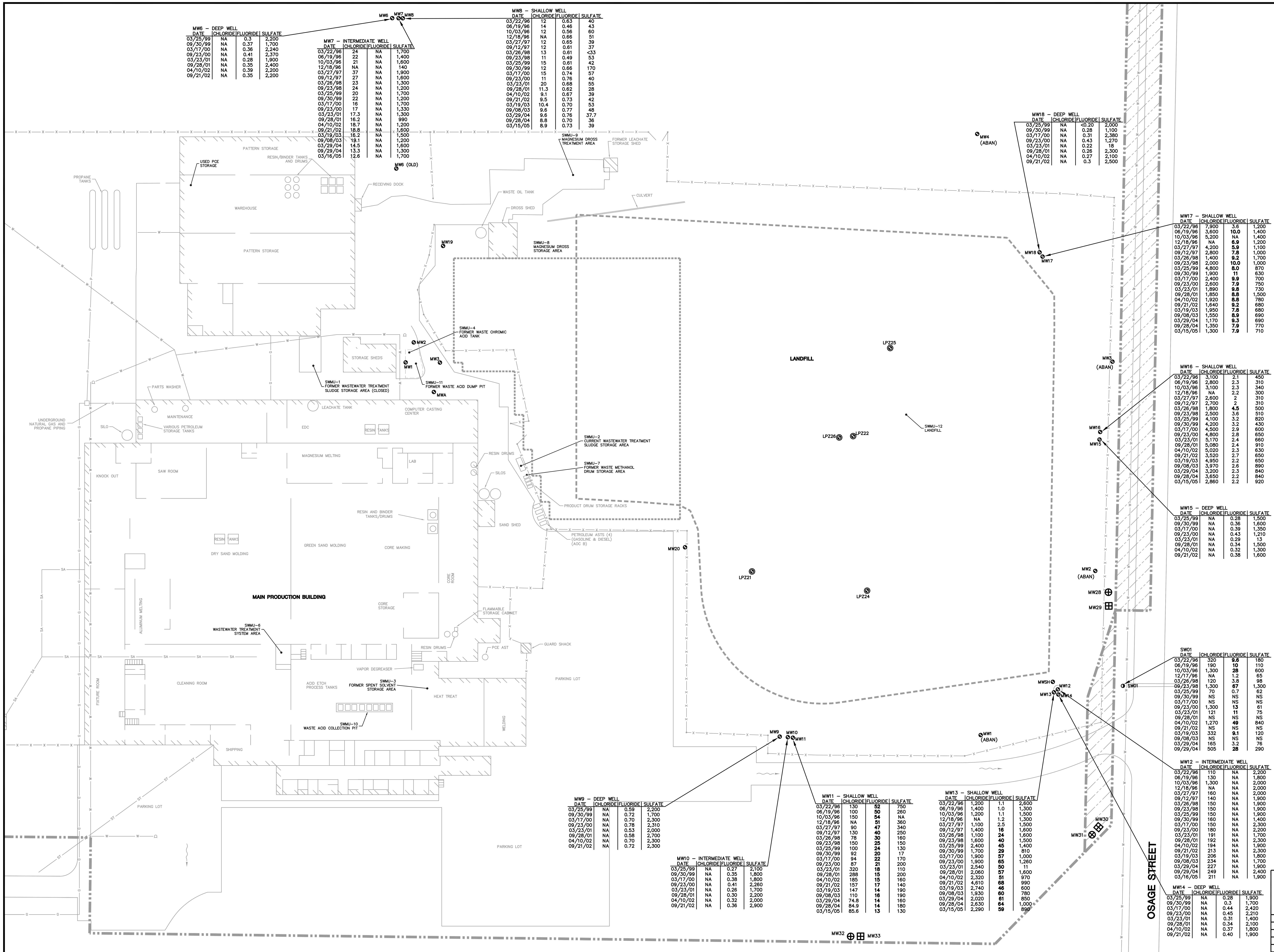
Figure 10
Exposure Pathway Evaluation
Landfill Groundwater Impact Area (SWMU 12)
Sampling and Analysis Plan / Quality Assurance Project Plan
Wellman Dynamics, Creston, Iowa



		Current					
		Human				Biota	
Media Pathway	Exposure Route	Residential	Ind Worker	Constr Worker	Trespasser	Terrestrial	Aquatic
Groundwater	Ingestion	?	N	P	N	N	N
	Inhalation	?	N	N	N	N	N
	Dermal	?	N	P	N	N	N
Surface water	Ingestion	?	N	N	N	?	?
	Inhalation	?	N	N	N	?	?
	Dermal	?	N	N	N	?	?
Sediment	Ingestion	?	N	N	N	?	?

N - Pathway not completed.
? - Pathway completion not known.
P - Pathway potentially completed.

Note: Pathways other than groundwater are not part of the RFI and are addressed under the IDNR sanitary landfill permit program.



MW6 – DEEP WELL

DATE	CHLORIDE	FLUORIDE	SULFATE
03/25/99	NA	0.3	2,200
09/30/99	NA	0.37	1,700
03/17/00	NA	0.36	2,240
09/23/00	NA	0.41	2,370
03/23/01	NA	0.28	1,900
09/28/01	NA	0.35	2,400
04/10/02	NA	0.39	2,200
09/21/02	NA	0.35	2,200

MW7 – INTERMEDIATE WELL

DATE	CHLORIDE	FLUORIDE	SULFATE
03/22/96	24	NA	1,700
06/19/96	22	NA	1,400
10/03/96	21	NA	1,600
12/18/96	NA	NA	140
03/27/97	37	NA	1,900
09/12/97	27	NA	1,600
03/26/98	23	NA	1,300
09/23/98	24	NA	1,200
03/25/99	20	NA	1,700
09/30/99	22	NA	1,200
03/17/00	16	NA	1,700
09/23/00	17	NA	1,330
03/23/01	17.3	NA	1,300
09/28/01	16.2	NA	990
04/10/02	18.7	NA	1,200
09/21/02	18.8	NA	1,600
03/19/03	16.2	NA	1,500
09/08/03	19.1	NA	1,200
03/29/04	14.5	NA	1,600
09/29/04	13.3	NA	1,300
03/16/05	12.6	NA	1,700

MW8 – SHALLOW WELL

DATE	CHLORIDE	FLUORIDE	SULFATE
03/22/96	12	0.63	40
06/19/96	14	0.46	43
10/03/96	12	0.56	60
12/18/96	NA	0.66	51
03/27/97	12	0.65	39
09/12/97	12	0.61	37
03/26/98	13	0.61	<33
09/23/98	11	0.49	53
03/25/99	15	0.61	42
09/30/99	12	0.66	170
03/17/00	15	0.74	57
09/23/00	11	0.76	40
03/23/01	20	0.68	55
09/28/01	11.3	0.62	28
04/10/02	9.1	0.67	39
09/21/02	9.5	0.73	42
03/19/03	10.4	0.70	53
09/08/03	9.6	0.77	48
03/29/04	9.6	0.76	37.7
09/28/04	8.8	0.70	36
03/15/05	8.9	0.73	39

MW18 – DEEP WELL

DATE	CHLORIDE	FLUORIDE	SULFATE
03/25/99	NA	<0.20	2,000
09/30/99	NA	0.28	1,100
03/17/00	NA	0.31	2,380
09/23/00	NA	0.43	1,270
03/23/01	NA	0.22	18
09/28/01	NA	0.26	2,300
04/10/02	NA	0.27	2,100
09/21/02	NA	0.3	2,500

MW17 – SHALLOW WELL

DATE	CHLORIDE	FLUORIDE	SULFATE
03/22/96	7,900	3.6	1,200
06/19/96	3,600	**10.0**	1,400
10/03/96	5,200	NA	1,400
12/18/96	NA	**6.9**	1,200
03/27/97	4,200	**5.9**	1,100
09/12/97	2,800	**7.8**	1,000
03/26/98	1,400	**9.2**	1,700
09/23/98	2,000	**10.0**	1,000
03/25/99	4,800	**8.0**	870
09/30/99	1,900	**11**	630
03/17/00	2,400	**9.9**	700
09/23/00	2,600	**7.9**	750
03/23/01	1,890	**9.8**	730
09/28/01	1,850	**8.8**	1,500
04/10/02	1,920	**8.8**	780
09/21/02	1,640	**9.2**	680
03/19/03	1,950	**7.8**	680
09/08/03	1,550	**8.9**	690
03/29/04	1,170	**9.3**	690
09/28/04	1,350	**7.9**	770
03/15/05	1,300	**7.9**	710

MW16 – SHALLOW WELL

DATE	CHLORIDE	FLUORIDE	SULFATE
03/22/96	3,100	2.1	450
06/19/96	2,800	2.3	310
10/03/96	3,100	2.3	340
12/18/96	NA	2.2	300
03/27/97	2,600	2	310
09/12/97	2,700	2	310
03/26/98	1,800	**4.5**	500
09/23/98	2,500	3.6	510
03/25/99	4,100	3.2	820
09/30/99	4,200	3.2	430
03/17/00	4,500	2.9	600
09/23/00	4,800	2.8	650
03/23/01	5,170	2.4	660
09/28/01	5,080	2.4	910
04/10/02	5,020	2.3	630
09/21/02	3,520	2.7	650
03/19/03	4,950	2.2	650
09/08/03	3,970	2.6	890
03/29/04	3,200	2.3	840
09/28/04	3,650	2.2	840
03/15/05	2,860	2.2	920

MW15 – DEEP WELL

DATE	CHLORIDE	FLUORIDE	SULFATE
03/25/99	NA	0.28	1,500
09/30/99	NA	0.36	1,600
03/17/00	NA	0.39	1,350
09/23/00	NA	0.43	1,210
03/23/01	NA	0.29	13
09/28/01	NA	0.34	1,500
04/10/02	NA	0.32	1,300
09/21/02	NA	0.38	1,600

SW01

DATE	CHLORIDE	FLUORIDE	SULFATE
03/22/96	320	**9.6**	180
06/19/96	190	**10**	110
10/03/96	1,300	**28**	600
12/17/96	NA	1.2	65
03/26/98	120	3.8	98
09/23/98	1,300	**67**	1,300
03/25/99	70	0.7	62
09/30/99	NS	NS	NS
03/17/00	NS	NS	NS
09/23/00	1,300	**13**	61
03/23/01	121	**11**	75
09/28/01	NS	NS	NS
04/10/02	1,270	**49**	840
09/21/02	NS	NS	NS
03/19/03	332	**9.1**	120
09/08/03	NS	NS	NS
03/29/04	165	3.2	76
09/29/04	505	**28**	290

MW12 – INTERMEDIATE WELL

DATE	CHLORIDE	FLUORIDE	SULFATE
03/22/96	110	NA	2,200
06/19/96	130	NA	1,800
10/03/96	1,300	NA	2,000
12/18/96	NA	NA	2,000
03/27/97	160	NA	2,000
09/12/97	140	NA	1,900
03/26/98	150	NA	1,900
09/23/98	150	NA	1,900
03/25/99	150	NA	1,900
09/30/99	160	NA	1,400
03/17/00	150	NA	2,300
09/23/00	180	NA	2,200
03/23/01	191	NA	1,700
09/28/01	192	NA	2,300
04/10/02	194	NA	1,900
09/21/02	213	NA	2,300
03/19/03	206	NA	1,800
09/08/03	234	NA	1,700
03/29/04	227	NA	1,900
09/29/04	249	NA	2,400
03/16/05	211	NA	1,900

MW14 – DEEP WELL

DATE	CHLORIDE	FLUORIDE	SULFATE
03/25/99	NA	0.28	1,900
09/30/99	NA	0.3	1,700
03/17/00	NA	0.44	2,420
09/23/00	NA	0.45	2,210
03/23/01	NA	0.31	1,400
09/28/01	NA	0.34	2,100
04/10/02	NA	0.37	1,800
09/21/02	NA	0.40	1,900

MW9 – DEEP WELL

DATE	CHLORIDE	FLUORIDE	SULFATE
03/25/99	NA	0.59	2,200
09/30/99	NA	0.72	1,700
03/17/00	NA	0.70	2,300
09/23/00	NA	0.78	2,310
03/23/01	NA	0.53	2,000
09/28/01	NA	0.58	2,700
04/10/02	NA	0.70	2,300
09/21/02	NA	0.72	2,300

MW10 – INTERMEDIATE WELL

DATE	CHLORIDE	FLUORIDE	SULFATE
03/25/99	NA	0.27	2,100
09/30/99	NA	0.35	1,800
03/17/00	NA	0.38	1,800
09/23/00	NA	0.41	2,260
03/23/01	NA	0.26	1,700
09/28/01	NA	0.30	2,200
04/10/02	NA	0.32	2,000
09/21/02	NA	0.36	2,900

MW11 – SHALLOW WELL

DATE	CHLORIDE	FLUORIDE	SULFATE
03/22/96	130	**52**	750
06/19/96	100	**50**	260
10/03/96	150	**54**	NA
12/18/96	NA	**51**	360
03/27/97	90	**47**	340
09/12/97	130	**40**	250
03/26/98	78	**30**	160
09/23/98	150	**25**	150
03/25/99	100	**24**	130
09/30/99	92	**20**	17
03/17/00	94	**22**	170
09/23/00	87	**21**	200
03/23/01	320	**18**	110
09/28/01	288	**15**	200
04/10/02	185	**15**	160
09/21/02	157	**17**	140
03/19/03	147	**14**	190
09/08/03	110	**16**	190
03/29/04	74.8	**14**	160
09/28/04	84.9	**14**	180
03/15/05	85.6	**13**	130

MW13 – SHALLOW WELL

DATE	CHLORIDE	FLUORIDE	SULFATE
03/22/96	1,200	1.1	2,600
06/19/96	1,400	1.0	1,300
10/03/96	1,200	1.1	1,500
12/18/96	NA	1.2	1,300
03/27/97	1,100	2.5	1,500
09/12/97	1,400	**16**	1,600
03/26/98	1,100	**24**	1,600
09/23/98	1,600	**40**	1,500
03/25/99	2,400	**45**	1,400
09/30/99	1,700	**29**	810
03/17/00	1,900	**57**	1,000
09/23/00	1,900	**65**	1,260
03/23/01	2,540	**50**	11
09/28/01	2,060	**57**	1,600
04/10/02	2,320	**51**	970
09/21/02	4,610	**68**	990
03/19/03	2,740	**46**	600
09/08/03	1,930	**60**	780
03/29/04	2,020	**61**	850
09/28/04	2,630	**64**	1,000
03/15/05	2,290	**59**	890

LEGEND

Wel-B1	SOIL BORING
MW12	MONITORING WELL
LPZ24	LEACHATE PIEZOMETER
SW01	SURFACE WATER MONITORING POINT
	PROPOSED WATER TABLE MONITORING WELL
	PROPOSED PIEZOMETER
	APPROXIMATE LANDFILL BOUNDARY
	APPROXIMATE RADIOLOGICAL INVESTIGATION AREA BOUNDARY
	APPROXIMATE PROPERTY LINE
	FACILITY PROPERTY WITH GRANTED EASEMENT
—x—x—x—	FENCE
G	GAS MAIN
P	ABOVEGROUND PROPANE PIPING
SA	SANITARY SEWER
ST	STORM SEWER
W	WATER MAIN
	HYDRANT
	SURFACE DRAINAGE
SWMU	SOLID WASTE MANAGEMENT UNIT (NOTE: SWMU 5 NOT SHOWN BECAUSE IT IS A FORMER PORTABLE TANK)
AOC	AREA OF CONCERN (NOTE: AOC A IS NOT IDENTIFIED AS A SPECIFIC POINT BECAUSE IT INCLUDES SEVERAL LOCATIONS OF VOC GROUNDWATER CONTAMINATION EAST AND NORTH OF THE MAIN BUILDING)
NA	NOT ANALYZED
(ABAN)	ABANDONED MONITORING WELL

NOTES:

1. SEE FIGURE 2 FOR BASE MAP NOTES.
2. NOT ALL RESULTS SHOWN. DISPLAYED RESULTS ARE PRIMARY LANDFILL CONTAMINANTS OF CONCERN.
3. RESULTS IN MG/L EXCEPT WHERE NOTED OTHERWISE.
4. BOLD VALUES EXCEED UNITED STATED ENVIRONMENTAL PROTECTION AGENCY PRIMARY DRINKING WATER MAXIMUM CONTAMINANT LEVELS.
5. DATA FROM WELLS MW6–MW18 FROM ANNUAL WATER QUALITY REPORTS AND SEMIANNUAL WATER QUALITY REPORTS PREPARED BY EARTH SCIENCE CONSULTANTS, INC. OR FROM TEST AMERICA LABORATORY REPORTS (3/04–3/05).
6. PROPOSED WELL LOCATIONS ARE APPROXIMATE AND WILL BE ADJUSTED BASED ON ACCESS AND FIELD CONDITIONS.

50 0 50

SCALE: 1" = 50'

FIGURE 11
SAMPLING PLAN–LANDFILL GROUNDWATER IMPACTS
RCRA FACILITY INVESTIGATION WORKPLAN
WELLMAN DYNAMICS CORPORATION
CRESTON, IOWA

PROJECT NO. 2631
DRAWN BY: KP
CHECKED BY: SC
APPROVED BY:
DRAWN: 08/22/05
REVISED: 04/04/06

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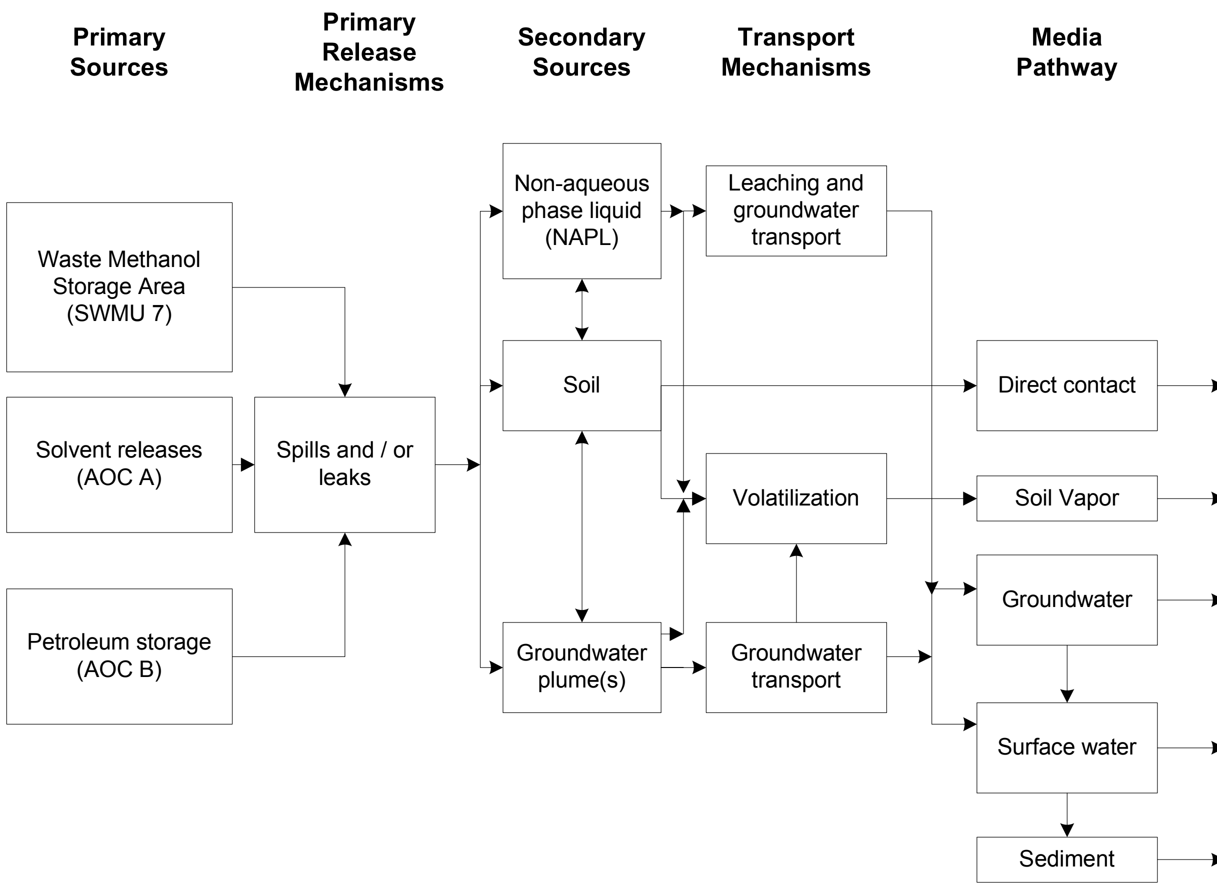
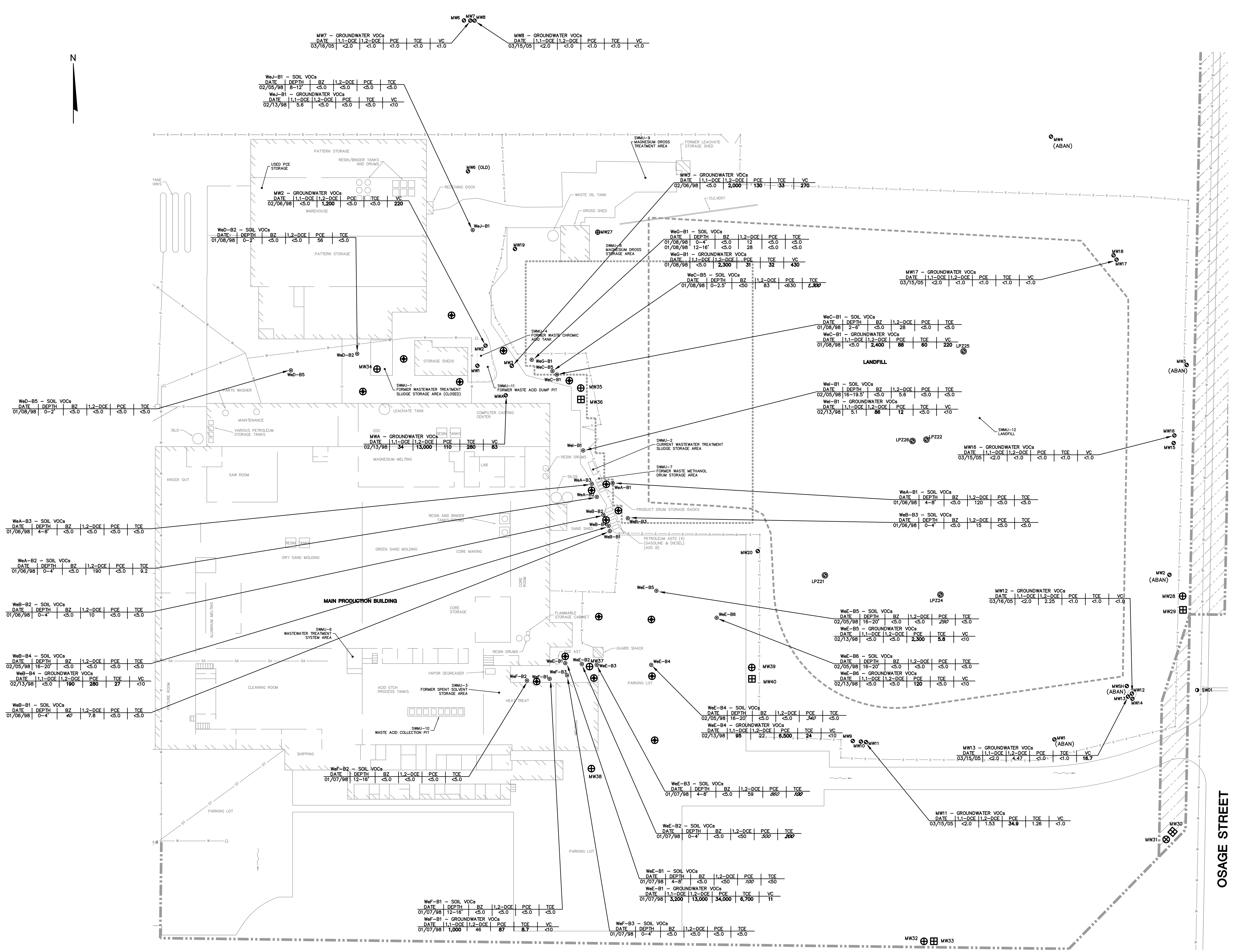
Figure 12
Exposure Pathway Evaluation
VOC Release Areas (AOCs A&B and SMWU 7)
Sampling and Analysis Plan / Quality Assurance Project Plan
Wellman Dynamics, Creston, Iowa



Media Pathway	Exposure Route	Current: Human – Residential	Human – Ind Worker	Human – Constr Worker	Human – Trespasser	Biota – Terrestrial	Biota – Aquatic
Direct contact	Ingestion	N	N	P	N	N	N
	Dermal	N	N	P	N	N	N
Soil Vapor	Inhalation	?	?	P	N	N	N
Groundwater	Ingestion	?	N	P	N	N	N
	Inhalation	?	N	P	N	N	N
	Dermal	?	N	P	N	N	N
Surface water	Ingestion	?	N	N	N	?	?
	Inhalation	?	N	N	N	?	?
	Dermal	?	N	N	N	?	?
Sediment	Ingestion	?	N	N	N	?	?

N - Pathway not completed.
? - Pathway completion not known.
P - Pathway potentially completed.



LEGEND

WeJ-B1	SOIL BORING
WeC-CS	COMPOSITE SAMPLE
MW12	MONITORING WELL
LPZ24	LEACHATE PIEZOMETER
SW01	SURFACE WATER MONITORING POINT
	PROPOSED WATER TABLE MONITORING WELL
	PROPOSED PIEZOMETER
	PROPOSED GEOPROBE BORING
	APPROXIMATE LANDFILL BOUNDARY
	APPROXIMATE RADIOLOGICAL INVESTIGATION AREA BOUNDARY
	APPROXIMATE PROPERTY LINE
	FACILITY PROPERTY WITH GRANTED EASEMENT
	FENCE
	GAS MAIN
	ABOVEGROUND PROPANE PIPING
	SANITARY SEWER
	STORM SEWER
	WATER MAIN
	HYDRANT
	SURFACE DRAINAGE
SWMU	SOLID WASTE MANAGEMENT UNIT (NOTE: SWMU 5 NOT SHOWN BECAUSE IT IS A FORMER PORTABLE TANK)
AOC	AREA OF CONCERN (NOTE: AOC A IS NOT IDENTIFIED AS A SPECIFIC POINT BECAUSE IT INCLUDES SEVERAL LOCATIONS OF VOC GROUNDWATER CONTAMINATION EAST AND NORTH OF THE MAIN BUILDING)
(ABAN)	ABANDONED MONITORING WELL

SOIL ANALYTICAL RESULTS LEGEND

BZ	BENZENE (μg/kg)
1,2-DCE	cis-1,2-DICHLOROETHENE (μg/kg)
PCE	TETRACHLOROETHENE (μg/kg)
TCE	TRICHLOROETHENE (μg/kg)

GROUNDWATER ANALYTICAL RESULTS LEGEND

1,1-DCE	1,1-DICHLOROETHENE (μg/l)
1,2-DCE	cis-1,2-DICHLOROETHENE (μg/l)
PCE	TETRACHLOROETHENE (μg/l)
TCE	TRICHLOROETHENE (μg/l)
VC	VINYL CHLORIDE (μg/l)

NOTES:

1. SEE FIGURE 2 FOR BASE MAP NOTES.
2. NOT ALL RESULTS SHOWN. DISPLAYED RESULTS ARE PRIMARY CONTAMINANTS OF CONCERN.
3. BOLD SOIL VALUES EXCEED INGESTION OR INHALATION EPA GENERIC SSLs.
4. BOLD GROUNDWATER VALUES EXCEED PRIMARY MCL.
5. ITALIC SOIL VALUES EXCEED MIGRATION TO GROUNDWATER EPA GENERIC SSLs.
6. BOLD AND ITALIC SOIL VALUES EXCEED INGESTION OR INHALATION PATHWAY AND MIGRATION TO GROUNDWATER EPA GENERIC SSLs.
7. DATA COMPILED FROM LABORATORY ANALYTICAL REPORTS DATED JANUARY 29, 1998; FEBRUARY 24, 1998; AND FEBRUARY 25, 1998, ANTECH, LTD., EXPORT, PENNSYLVANIA; MARCH 24, 2005, TEST AMERICA, CEDAR RAPIDS, IOWA.
8. GEOPROBE BORING AND MONITORING WELL LOCATIONS ARE APPROXIMATE AND ARE INTENDED TO SHOW THE CONCEPTUAL APPROACH. ACTUAL LOCATIONS WILL DEPEND ON SOIL SAMPLING RESULTS AS SAMPLING PROCEEDS AND ON ACCESS LIMITATIONS.
9. 17 OF 20 PROPOSED BORINGS SHOWN FOR VOC INVESTIGATION. REMAINING 3 BORING LOCATIONS WILL BE DETERMINED BASED ON FIELD RESULTS FROM THE FIRST 17 BORINGS.

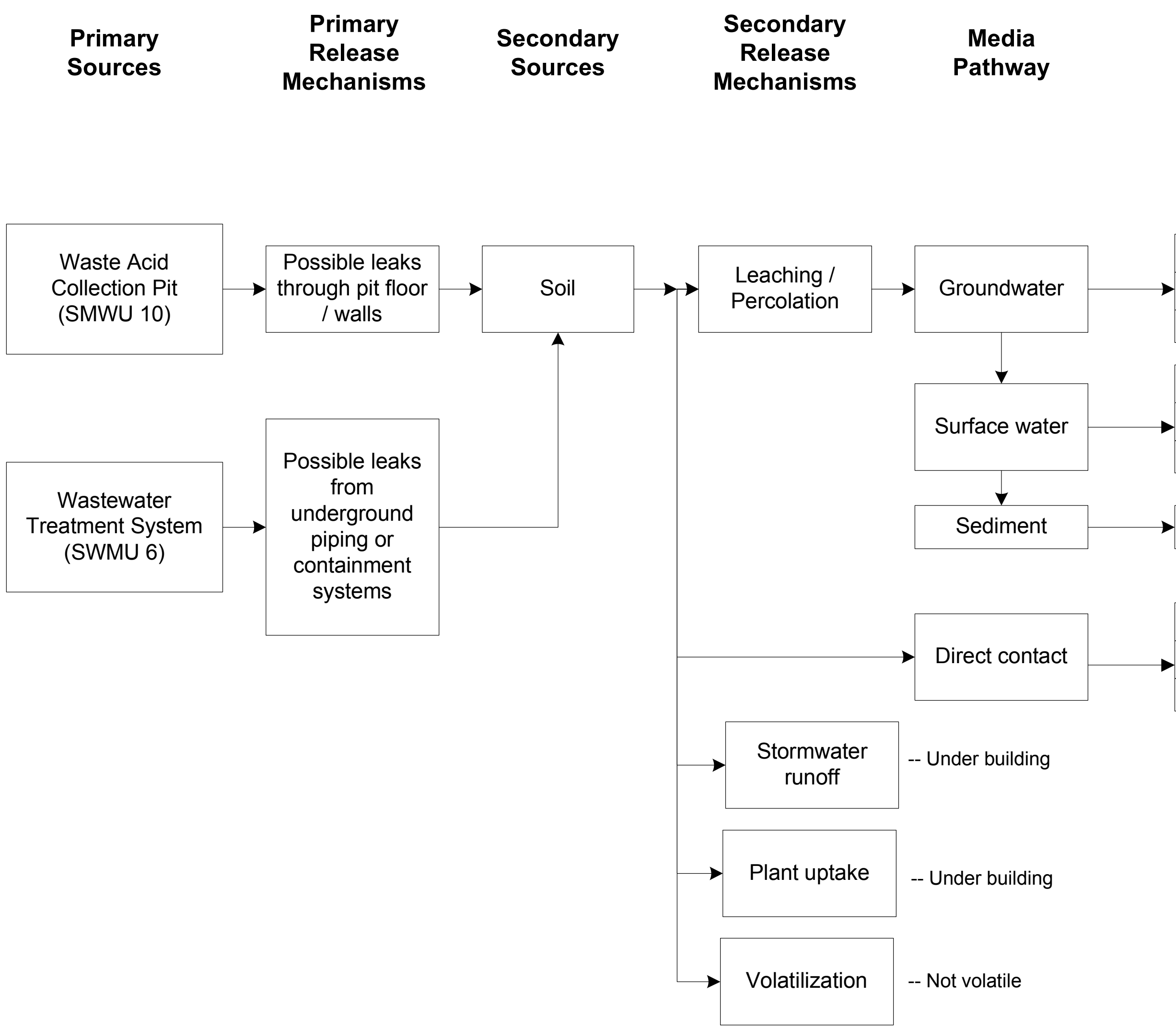
50 0 50

SCALE: 1" = 50'

FIGURE 13
SAMPLING PLAN – VOC RELEASE AREAS
RCRA FACILITY INVESTIGATION WORKPLAN
WELLMAN DYNAMICS CORPORATION
CRESTON, IOWA

PROJECT NO. 2631
DRAWN BY: KP
CHECKED BY: SC
APPROVED BY: SC
DRAWN: 08/22/05
REVISED: 04/04/06

Figure 14
Exposure Pathway Evaluation
Wastewater Treatment System and Waste Acid Collection Pit Area (SMWUs 6 & 10)
Sampling and Analysis Plan / Quality Assurance Project Plan
Wellman Dynamics, Creston, Iowa



Media Pathway	Exposure Route	Current					
		Human				Biota	
		Residential	Ind Worker	Constr Worker	Trespasser	Terrestrial	Aquatic
Groundwater	Ingestion	?	N	?	N	N	N
	Inhalation	?	N	?	N	N	N
	Dermal	?	N	?	N	N	N
Surface water	Ingestion	?	N	N	N	?	?
	Inhalation	?	N	N	N	?	?
	Dermal	?	N	N	N	?	?
Sediment	Ingestion	?	N	N	N	?	?
Direct contact	Ingestion	N	N	?	N	N	N
	Inhalation	N	N	?	N	N	N
	Dermal	N	N	?	N	N	N

N - Pathway not completed.
? - Pathway completion not known.
P - Pathway potentially completed.

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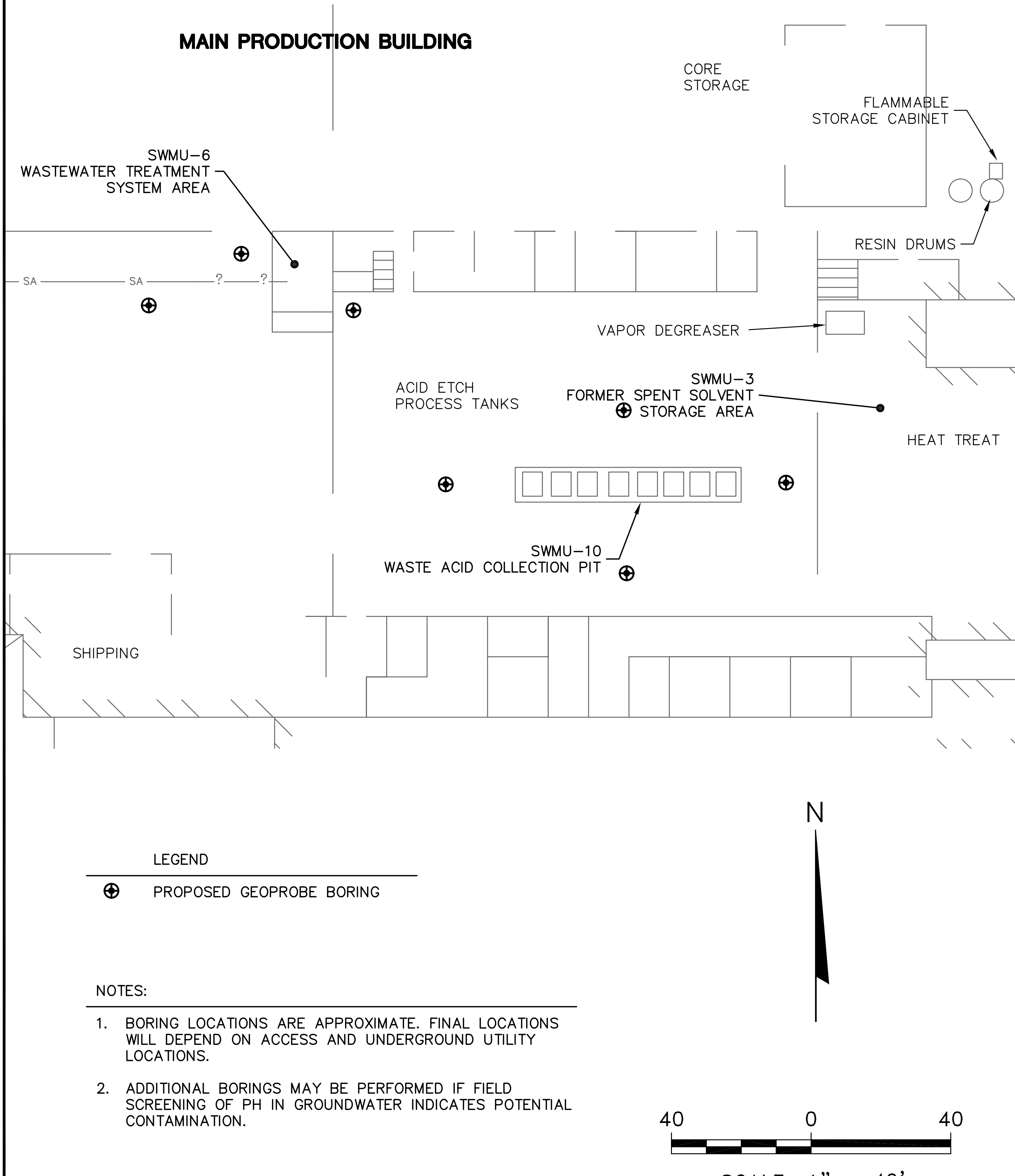

NOTES:

1. BORING LOCATIONS ARE APPROXIMATE. FINAL LOCATIONS WILL DEPEND ON ACCESS AND UNDERGROUND UTILITY LOCATIONS.
2. ADDITIONAL BORINGS MAY BE PERFORMED IF FIELD SCREENING OF PH IN GROUNDWATER INDICATES POTENTIAL CONTAMINATION.

PROJECT NO. 2631	FIGURE 15
DRAWN BY: KP	SAMPLING PLAN – WASTEWATER TREATMENT
CHECKED BY: SC	SYSTEM AND WASTE ACID COLLECTION PIT AREA
APPROVED BY: SC	RCRA FACILITY INVESTIGATION WORKPLAN
DRAWN: 08/15/05	WELLMAN DYNAMICS CORPORATION
REVISED: 09/08/05	CRESTON, IOWA

BT² inc.

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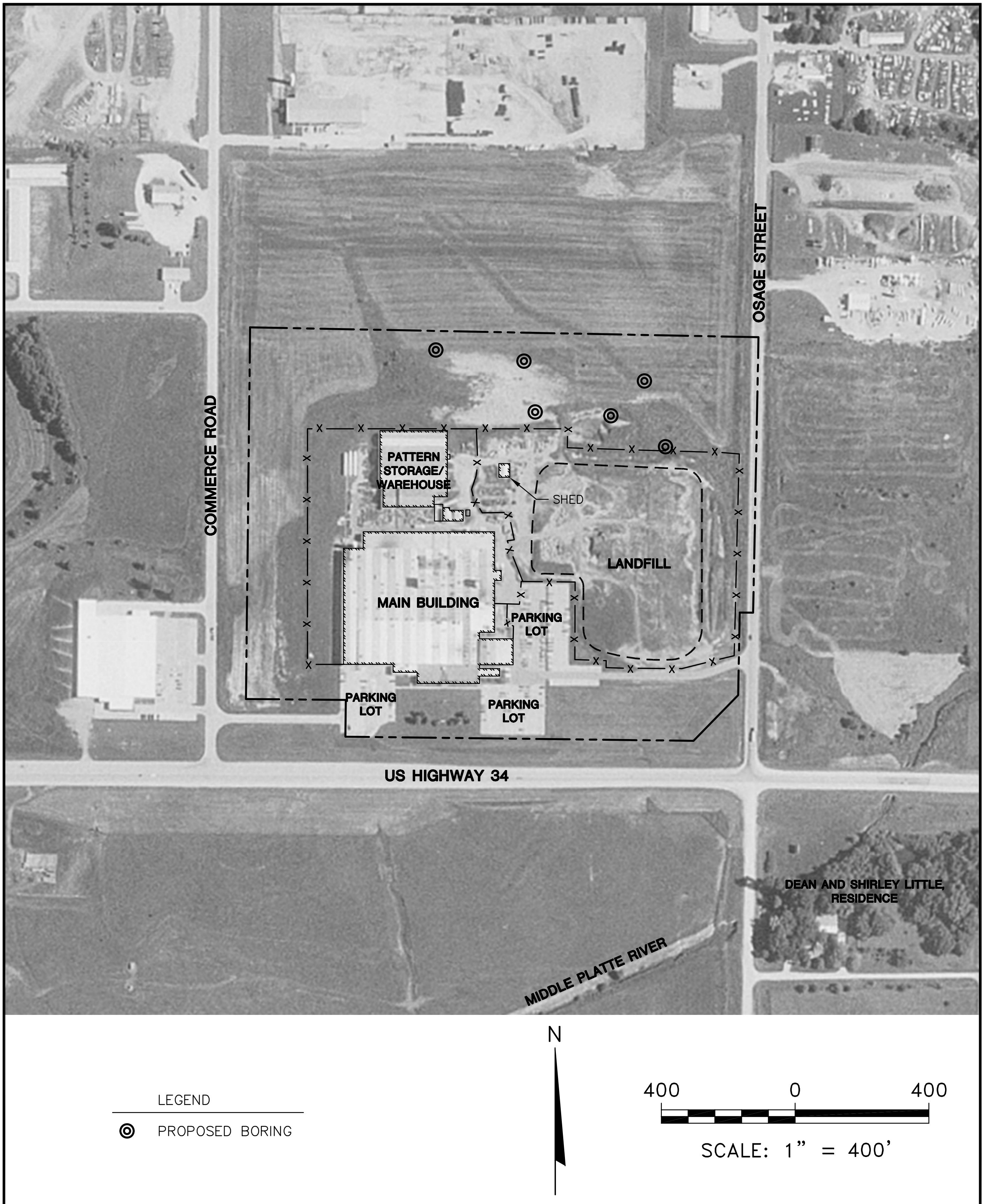

PROJECT NO. 2631	
DRAWN BY: KP	
CHECKED BY: SMS	
APPROVED BY: SC	
DRAWN: 04/18/06	
REVISED: 04/18/06	

FIGURE 16
BACKGROUND SAMPLING LOCATIONS
RCRA FACILITY INVESTIGATION WORKPLAN
WELLMAN DYNAMICS CORPORATION
CRESTON, IOWA

BT² inc.

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APPENDIX A

Resumes of Key Personnel

Sherren Clark, P.E., P.G.

Principal, Senior Engineer

Areas of Expertise

- Soil and Groundwater Remediation
- Solid Waste Management
- Groundwater Modeling

Education

M.S., Civil and Environmental Engineering, University of Wisconsin-Madison

B.A., Geology, Carleton College

Registration

Professional Engineer, Wisconsin

Professional Geologist, Wisconsin

Professional History

Principal/Project Manager,
BT^2, Inc., 1992 to Present

Project Engineer/Hydrogeologist,
Dames & Moore, 1987 to 1992

Affiliations

American Society of Civil Engineers (ASCE)

Association of Groundwater Scientists and Engineers (AGWSE)

Wisconsin Ground Water Association

Publications and Presentations

Stochastic Models of Dispersion in Heterogeneous Aquifers, 1988, UW-Madison, Master's Report.

Modeling of Satellite Measured Magnetic Anomalies, 1984, EOS, American Geophysical Union.

Project presentations for public meetings and regulatory agency meetings for many projects.

REPRESENTATIVE EXPERIENCE

Ms. Clark has applied her combined background in hydrogeology and civil engineering to develop integrated project solutions from the investigation phase through design and construction. Her projects have included hydrogeologic investigation, remedial action, solid waste facility design and construction, compliance evaluation, and water resource engineering.

Contamination Investigation and Remediation

- Managed remedial investigation for a large former wood treatment facility in central Michigan. Managed the site investigation including review of historical records, drilling and sampling of soil borings and monitoring wells, surface water sampling and sediment sampling.

- Project manager for over 30 petroleum storage tank remediation sites. Remediation techniques have included soil excavation, soil venting, air sparging, groundwater extraction and treatment, and natural attenuation. For several active gas stations, remediation activities were coordinated with station upgrades to minimize down time.

- Managed remedial investigation for former herbicide storage facility contaminated with 2,4,5-T. The project also required hazardous waste management for dioxin-containing wastes.

- Managed site investigation and remedial design for a solvent release at a nuclear power plant in Michigan. Due to security requirements, the investigation was completed using innovative field methods to define the plume with a minimum number of field mobilizations.

- Performed PCB spill cleanup verification sampling for three PCB spill sites at substations. Also applied EPA's specified cleanup verification approach to investigating potential contamination at former substations prior to property sale or reuse.

Solid Waste Management

- Managed Initial Site Report preparation for an industrial waste landfill in southern Wisconsin.

- Managed Feasibility Report preparation for a municipal solid waste landfill in central Wisconsin.

- Provided peer review focused on regulatory completeness for a Feasibility Report for a landfill expansion in southern Wisconsin.

- Managed construction documentation for three phases of final cover installation at an ash landfill in Wisconsin. The landfill cover design included a geosynthetic clay liner (GCL) for the barrier layer. Also prepared plan modifications for changes in cover grades, cover materials, and surface water management.

- Managed investigation of VOC contamination at a municipal solid waste landfill in southern Wisconsin. The project included monitoring well installation, geophysical borehole logging, monitoring data evaluation, development of a monitoring database, and report preparation, as well as replacement of six water supply wells in the landfill area.

- Performed groundwater modeling for a contamination investigation at a paper company landfill in Wisconsin.

- Managed remedial investigations at two landfills in southern Wisconsin.

- Managed groundwater monitoring programs at more than 12 landfills.

Civil Engineering and Water Resources

- Performed failure analysis and review of remedial options for a failed articulated concrete block revetment installed in an urban river.

- Managed multidisciplinary investigation at a hydroelectric power plant to address various issues raised by the Federal Energy Regulatory Commission as part of their safety inspection process. The project included geotechnical evaluation of an earthen dam, investigation of soil conditions below a concrete spillway, and design of a deicing system to be installed upstream of the dam.

- Prepared a management plan to meet WDNR wastewater requirements for four seepage ponds at a coal-fired power plant in Wisconsin.

- Assisted a utility in evaluation of options for expansion of the coal pile at a power plant.

Environmental Compliance

- Performed environmental compliance assessments for four power plants, focusing on solid waste, wastewater, drinking water and laboratory practices.
- Developed solid waste compliance checklists for a utility client to use as part of their annual compliance certification process for their ash landfills.
- Performed environmental compliance assessments for two water utilities, focusing on drinking water and hazardous materials storage requirements.

Environmental Site Assessments

- Performed Phase 1 environmental site assessments for property transactions at several facilities, including commercial, residential and agricultural properties.
- Performed Phase 2 environmental site assessments to address potential contamination issues including underground storage tanks, potential agrichemical contamination, and potential metals contamination in fill materials.

Thomas J. Culp, P.G.

Senior Project Manager

Areas of Expertise

- Soil and Groundwater Investigation and Remediation
- Hydrogeologic Investigation and Interpretation
- Agriculture Site Investigation and Remediation

Education

B.S., Geology, University of Wisconsin, Madison, Wisconsin

Certifications

Hydrogeologist, State of Wisconsin, as defined in s. NR 712.03 (1), Wis. Adm. Code

Certified Site Assessor for Petroleum Underground Tank System Removals in Wisconsin

OSHA 40-Hour Health and Safety Training

Registration

Professional Geologist, Wisconsin

Professional History

Hydrogeologist/Senior Project Manager, BT^2, Inc., 1995 to present

Hydrogeologist, Keil Environmental Engineering, Inc., 1992 to 1995

Environmental Scientist, Eldredge Engineering Associates/Wehran Envirotech, 1989 to 1992

Research Triangle Institute, 1988 to 1989

Affiliations

Association of Groundwater Scientists and Engineers (AGWSE)

Wisconsin Ground Water Association (WGWA)

Continuing Education

Write for Results Training Program, January 2001

REPRESENTATIVE EXPERIENCE

Mr. Culp is a hydrogeologist with 15 years experience in the environmental consulting field. He is educated in the field of hydrogeology and has experience in the investigation and remediation of sites with soil and groundwater contamination. His projects have included hydrogeologic investigations, remedial actions, agrichemical soil and groundwater investigations, solid waste facility monitoring, and environmental site assessments. Details of Mr. Culp's project experience are presented below.

Soil and Groundwater Remediation

- Participated in soil, groundwater, sediment, surface water, and waste investigations at over 100 sites, including properties with contamination from solid and hazardous wastes, petroleum products, chlorinated solvents, industrial chemicals, agrichemicals, and heavy metals. For many sites, remediation activities were designed and coordinated with redevelopment construction activities to minimize costs and construction delays.

- Project manager for over 30 petroleum storage tank remediation sites. Remediation techniques have included soil excavation, soil venting, groundwater extraction and treatment, and natural attenuation.

Environmental Site Assessments

- Performed Phase 1 Environmental Site Assessments for property transactions at numerous facilities, including commercial, residential, and agricultural properties.

- Performed Phase 2 Environmental Site Assessments to address potential contamination issues including underground storage tanks, agrichemical contamination, chlorinated compounds, and metals contamination in fill materials.

Spill Response

- Performed many spill response cleanups throughout Wisconsin.

Solid Waste Management

- Installed and sampled monitoring well networks for hydrogeologic and groundwater contamination studies at municipal landfill sites in Illinois and Indiana.

WI Fertilizer, Aglime & Pesticide Management Conference, January, 1999, 2000, 2002

- Performed long-term groundwater elevation studies to determine surface water impacts on groundwater levels and landfill gas migration.
- Assisted in preparation of regulatory reporting documents for landfill operation and closure.

Agriculture Chemical Releases

- Managed more than 20 projects under Wisconsin's ACCP program.
- Projects have involved preparation of workplans, site investigation reports, remedial action plans, cost estimates, and bidding documents; oversight of soil excavation, landspreading and soil boring and monitoring well installation; documentation of soil and bedrock geological material; sampling soil and groundwater; coordination of soil and groundwater sampling plans and soil excavations.
- Managed budgets and costs to retain maximum eligibility for reimbursement by the ACCP fund.
- Managed regional sampling of over 400 residential water wells as part of a pesticide re-registration study for a major chemical manufacturer. Assisted in final statistical analysis of project data.

Stephen Sellwood, P.G.

Project Hydrogeologist

Areas of Expertise

- Hydraulic Testing
- Soil and Groundwater Investigations
- Groundwater Data Analysis

Education

B.S., Geology – University of Wisconsin-Eau Claire

M.S., Geology – University of Kansas

Certifications/Training

OSHA 40-Hour Health and Safety Training

Wisconsin Underground Storage Tank Site Assessor

Registration

Professional Geologist, Wisconsin

Professional History

Hydrogeologist, BT^2, Inc., November 2001 to Present

Field Research Geologist, Kansas Geological Survey, May 2000 to October 2001

Teaching Assistant, University of Kansas, August 2000 to May 2001

Teaching Assistant, University of Minnesota – Duluth, August 1999 to May 2000

Environmental Scientist, Advent Environmental Services, Inc., May 1999 to August 1999

Field Geologist, Geological Survey of Canada, June 1998 to August 1998

REPRESENTATIVE EXPERIENCE

Mr. Sellwood has four years of experience as a hydrogeologist. His experience includes investigating soil and groundwater contamination, hydraulic testing, and developing new methods of aquifer characterization. His project work has included commercial, industrial, and agrichemical sites.

Environmental Site Investigations

- BT^2: Directed and conducted a variety of investigative field work including groundwater monitoring, soil sampling, monitoring well installation, well development, slug testing, and field soil classification.

- Phase 2 Environmental Site Assessments: Performed soil and groundwater sampling, data analysis, and report writing for a variety of sites in Wisconsin.

- Tank Closure Site Assessments: Performed field screening and soil sampling to assess underground storage tank sites.

- Agrichemical Site Investigations: Designed and implemented site investigations and remedial actions at sites with agrichemical contamination. Work has included soil and groundwater sampling, soil excavation, and soil landspreading and landfilling.

- Dry Cleaner Site Investigations: Worked on dry cleaner projects with chlorinated solvent contamination in soil and groundwater.

- Petroleum Site Investigations: Worked on projects with petroleum contamination in soil and groundwater, including free-product removal and bedrock investigations.

- Kansas Geological Survey: Worked with project teams to develop new site investigation techniques, including direct-push electrical conductivity logging and direct-push hydraulic testing.

Hydraulic Testing

- BT^2: Worked with a project team on a groundwater study that involved monitoring aquifer water level changes in response to pumping rate changes of several high-capacity wells. Data collection included long-term monitoring with pressure transducers and data loggers, as well as manual water level measurements.

- BT²: Completed a program of slug tests for a proposed landfill expansion, which included 24 wells screened across a variety of formations. The project included appropriate slug test selection, performance, and data analysis.

- Kansas Geological Survey: Performed and analyzed slug tests for a hydraulic characterization project. Slug tests were performed at approximately 70 test points installed by direct-push techniques in a sand and gravel aquifer to determine three-dimensional distribution of hydraulic conductivity in the aquifer

STATEMENT OF QUALIFICATIONS
RISK ASSESSMENT

M. Carol McCartney, Ph.D., P.G.
Consulting Hydrogeologist
Risk Assessor

2205 Lakeland Avenue
Madison, Wisconsin 53704

Office: 608-241-4290
Mobile: 608-345-0613
mccartneypg@charter.net

SERVICES

Professional geologist providing project support and assistance to industry, consultants, and contractors in hydrogeology and risk assessment.

BACKGROUND

An environmental consultant since 1979, Dr. McCartney assists her clients by identifying, communicating, and implementing solutions to the business problems created by environmental issues. She has expertise in geologic and hydrogeologic investigations, statistical analysis, Superfund and RCRA issues, risk assessment, and risk-based closures. Positive working relationships with regulatory agencies. A team player.

CAPABILITIES

RCRA

- Corrective Action Program experience
- Risk-based closure standards development
- Environmental Indicator (EI) determinations
- Performance monitoring
- Compliance monitoring

Hydrogeology

- Groundwater flow and chemistry evaluations and monitoring
- Contaminant fate and transport assessments
- Non-Aqueous Phase Liquids (NAPLs)
- Monitored Natural Attenuation
- Statistical and Data Quality Evaluations
- Risk-based closure experience in MN, OR, WI, PA, IA, MI

Superfund (CERCLA)

- Remedial Investigation (RI) Task Leader, Lead Hydrogeologist, Risk Assessment Task Leader
- Baseline Human Health Assessment preparation and review
- Ecological Risk Assessment preparation
- Applicable or Relevant and Appropriate Requirements (ARARs) development
- Feasibility Study (FS) remedy analysis and selection
- Remedy selection and ROD development
- Brownfield redevelopment support

PROJECT SUMMARIES

RISK ASSESSMENT

HACCO – Pesticide Formulation Facility – RCRA Corrective Action (Randolph, WI). Risk Assessment Task Leader: Directed and reviewed preparation of a workplan to limit scope and to optimize data collection for multiple purposes, including risk assessment for releases of pesticides to soil and groundwater. Workplan required review by USEPA Region 5 and WiDNR.

Cook Composite and Polymers – Chemical Manufacturer RCRA Corrective Action (Saukville, WI). Risk Assessment Task Leader: Directed and reviewed workplan preparation for an investigation of limited scope to optimize data collection for a risk assessment. Off-site contamination of surface soils in residential and recreational areas by resins and solvents were the focus of the risk evaluation. USEPA Region 5 reviewed the Workplan.

Envotech – Hazardous Waste Landfill Permit Application (Milan, MI). Risk Assessor: Performed a failure mode analysis and risk assessment for a proposed RCRA landfill. The failure mode analysis included evaluation of possible releases to the environment from all landfill components and resulted in design modifications to reduce the potential for and effects of possible releases. The risk assessment qualitatively evaluated potential failures and quantitatively assessed liner failure with subsequent groundwater contamination. Potential risks were lower than acceptable levels for 100 years after landfill operation began.

Dyno Polymers – Voluntary Cleanup Program (OR). Project Manager - Lead Technical (Hydrogeology and Risk Assessment): Performed a limited remedial investigation that was deemed complete and conclusive by ODEQ in finding no significant risks to human health or the environment from three areas of the facility. An NFA letter was issued by ODEQ for methanol, formaldehyde, and diesel. Affected media included soil, groundwater, and sediments within perimeter ditches.

Dyno Polymers – Voluntary Investigation and Cleanup Program (MN). Project Manager - Lead Technical (Hydrogeology and Risk Assessment): Received a No Action letter after presenting a remedial investigation and risk evaluation report. Constituents were related to phenolic resins and urea formaldehyde.

Confidential Client – Incinerator Risk Assessment (SC). Risk Assessor: Performed a risk assessment for the air pathway and inhalation route of exposure for an incinerator in a residential neighborhood near a school. Risks and hazards were calculated the output of an air model (ISCST). The reasonable maximum receptor (RME) was assumed to be a child who lived in the neighborhood and attended the school. Results of the risk assessment were used at a public hearing.

Algoma County Landfill – Superfund Baseline Risk Assessment (Algoma, WI). Risk Assessor: Performed a baseline risk assessment for a municipal landfill that was a co-disposal site on the NPL Superfund list. The risk assessment was performed for the PRPs and focused on benzene in the groundwater pathway. The results indicated acceptable risk levels for current and future land use. The choice of remedial action (landfill cap) was driven by ARARs for iron and manganese.

Arkona Road Landfill – Act 307 Risk Assessment (Milan, MI). Risk Assessor: Performed a baseline risk assessment for a closed landfill on the Michigan Act 307 list. Evaluated the groundwater, surface water, and sediment pathways for human health effects. Quantified the risk due to exposure to PAHs in sediment near the site and found that current and future risks were below acceptable levels.

NIROP Soils Operable Unit – Baseline Risk Assessment (Fridley, MN). Risk Assessment Task Leader: Directed and reviewed production of a baseline human health and preliminary ecological assessment for VOCs, metals, PAHs, and pesticides in soil. The risks to workers under current land use were found to be below acceptable levels. Risks to residents under future land use were above acceptable levels. VOCs in soil pore gas in the hypothetical future residences drove the risk. Risks to environmental receptors were concluded to be minimal, and further ecological assessment was not necessary. USEPA Region 5 was the lead agency with review by MPCA.

Olmsted County Landfill – Baseline Risk Assessment (Rochester, MN). Risk Assessor: Performed a baseline risk assessment for a Superfund site that is a municipal landfill in a karst terrain. The MPCA was the lead agency with review by USEPA Region 5. The results of the risk assessment indicated risks were below acceptable levels for current land use and above acceptable levels under future residential land use due to vinyl chloride and methane in soil pore gas. Successfully argued for the use of institutional controls for the groundwater pathway under future land use.

Confidential Client – Urban Redevelopment Project – Baseline Human Health Assessment (Kenosha, WI). Risk Assessor: Performed a baseline risk assessment under current land use and multiple future land use scenarios for the redevelopment of a leveled site that had been an industrial facility for over 100 years. Future land use scenarios included industrial, commercial, and residential uses. Primary constituents were PAHs and lead. Lead was evaluated using the Uptake Biokinetic Model. The human health assessment was used to support the choice of remedial alternatives (evaluated per NR 700 guidelines).

Waste Management – Cereal City Landfill – Act 307 Risk Assessment (Battle Creek, MI). Risk Assessment Task Leader: Directed and reviewed production of a baseline risk assessment for a co-disposal site on the Michigan Act 307 list. Primary constituents of concern were arsenic and vinyl chloride. Groundwater and soil pore gas were the primary pathways that contributed to the quantified risk. Risks were acceptable under current land use but were above acceptable levels under future land use. The ultimate remedy was a permeable cap that reduced groundwater concentrations.

Rueping Leather Tannery – Wisconsin Environmental Repair Fund (ERF) (Fond du Lac, WI). Risk Assessment Task Leader: Assessed risks at this abandoned leather tannery slated for urban redevelopment. Arsenic in groundwater and heavy metals (chromium) in soil were the principle constituents of concern. A city well contained arsenic at unacceptable levels that were not connected to the site. The abandoned building posed an imminent hazard.

General Motors, Powertrain Division – Foundry Landfill (Defiance, OH). Risk Assessment Task Leader: Directed and reviewed production of an exposure assessment to demonstrate that there were not completed groundwater exposure pathways at the site. This assessment was used in support of a permit to install a landfill expansion.

Wisconsin DOT – Wausau Interchange (Wausau, WI). Risk Assessor: Prepared a risk assessment for exposure to lead in soil at a highway, using the Uptake Biokinetic (UKB) Model to support an argument for a target cleanup level for lead of 750 ppm. Based on these results, negotiated with WiDNR for a cleanup level of 500 ppm.

Stolper Industries – RCRA Storage Area Closure (DeWitt, IA). Risk Assessor: Used the Uptake Biokinetic (UBK) Model to assess the risk from exposure to lead in soil under a cautious, residential exposure scenario. The result of the risk assessment supported a target cleanup level of 750 ppm for this heavy metal. Based on these results, negotiated with USEPA Region 7 for a cleanup level of 500 ppm (from their original target of 200 ppm).

Green County Landfill – Risk Assessment (Brodhead, WI). Risk Assessment Task Leader: Directed and reviewed production of a human health assessment that included evaluating effects of VOCs in potable water and the potential food chain effects for drinking water for dairy cows. Limited remedial actions (water supply replacement and monitoring) were negotiated based on low potential for risk.

LGRL Landfill – Risk Assessment Review (Mayville, WI). Risk Assessment Task Leader: Negotiated scope and focus and reviewed and commented on draft risk assessment for the PRPs at this NPL site in Region 5. DNR contractor incorporated our comments on scope and focus as well as our review of the draft, which entered into the administrative record. Successfully kept off-site contamination that was not site-related (but with similar compounds) out of the risk assessment.

Briggs and Stratton – Foundry (Milwaukee, WI). Risk Assessor: Performed a failure mode analysis to assess long-term liability potential from effects on human health and the environment from septage application. The assessment was part of a beneficial re-use demonstration substituting foundry slag for lime treatment to kill bacteria. The results suggested that long-term liability potential is low and that the slag compared favorable to the lime treatment.

Confidential Client – Coal Gasification Site (MI). Risk Assessor: Performed a risk assessment that evaluated baseline risks and risk reduction associated with three remedial options for a coal tar site. Constituents of concern included PAHs, VOC, cyanide, and heavy metals. Costs for various levels of risk reduction were prepared for an options analysis.

ECOLOGICAL ASSESSMENTS

Arkona Road Landfill – Act 307 Remedial Action (MI). Risk Assessor: Performed an ecological assessment for sediments in a ditch adjacent to a closed hazardous waste landfill. Metals concentrations in the sediments were compared to apparent effect thresholds. The conclusions of the assessment were that there was no impact from the landfill and that no further investigation was necessary.

Urban Redevelopment Project (WI). Risk Assessor: Performed an ecological assessment that estimated metals concentrations in the groundwater discharge to surface water. Estimated concentrations were found to be below Water Quality Criteria.

Olmsted County Landfill – Baseline Ecological Assessment (MN). Risk Assessor: Performed an ecological assessment for a Superfund site that is a municipal landfill in a karst terrain. The results indicated that the groundwater discharge of VOCs to the surface water was estimated to be below Water Quality Criteria. Further investigation, such as sampling surface water or biota, was not needed.

NIROP Soils Operable Unit – Baseline Risk Assessment (MN). Risk Assessor: Performed a preliminary ecological assessment for VOCs, metals, PAHs, and pesticides in soils at the NIROP Naval Ordnance facility Superfund site. Successfully argued that the disturbed environment at the ordnance facility had little ecological significance, and, therefore, the soils would be expected to have little impact on environmental receptors. No further investigation of the environmental effects was required.

Bad River Indian Reservation – Environmental Assessment (WI). Quality Assurance: Evaluated lead concentrations in surface water and sediment and determined that Water Quality Criteria were not exceeded and that food chain effects were not expected. No further action was required.

EDUCATION/ TRAINING

USEPA Risk Assessment Methods – 1989
NWWA Risk Assessment Methods – 1988
Teaching Certificate, Edgewood College – Madison, WI, 2002
Ph.D., Geology, University of Wisconsin – Madison, 1979
M.S., Geology, University of Wisconsin – Madison, 1976
B.A., Geology, University of Colorado – Boulder, 1973
40-hour OSHA Health and Safety Training

REGISTRATIONS/ CERTIFICATIONS

Registered Professional Geologist - Illinois, Minnesota, Pennsylvania, and Wisconsin; Registered Well Driller in Missouri; WI PECFA Consultant

Mark McGowan
Quality Assurance Manager

Education

2003 BA Chemistry, University of Northern Iowa, Cedar Falls, Iowa

Special Interests

Data Evaluation and Validation
Quality Assurance / Assessment of Chemical Measurements
Laboratory Applications of Statistics

Experience

TestAmerica - Cedar Falls Division

Quality Assurance Manager, 2004 - Present

Maintains SOPs, monitors their compliance with current regulatory programs and monitors their use in the laboratory. Coordinates the QA/QC activities of the laboratory. Maintains the certification of the laboratory by various agencies. Maintains MDL studies. Ensures that the data produced by the laboratory is technically sound legally defensible and of consistently high quality in line with the National Quality Assurance Plan of TestAmerica, Inc.

TestAmerica - Cedar Falls Division

Analyst, 2001 – 2004

Performed metals analysis by ICP-AES and GFAA. Prepared samples for analysis. Analyzed samples for cyanide and oil and grease.

APPENDIX B

TestAmerica Quality Assurance/Quality Control Manual

QUALITY ASSURANCE / QUALITY CONTROL MANUAL

For

TestAmerica Analytical Testing Corp – Cedar Falls, IA
704 Enterprise Dr.
Cedar Falls, IA 50613
Ph. 319-277-2401
Fax: 319-277-2425

Effective Date: May 27, 2005
(See Table of Contents for Revision Dates of Each Section)

Prepared by: Mark McGowan
TestAmerica Analytical Testing Corp – Cedar Falls, IA
and
TestAmerica Incorporated
122 Lyman St
Asheville, NC 28803
(828) 258-3746

Uncontrolled Copy

CF13-01.5

This QA manual is reviewed on a minimum of an annual basis. This copy is not automatically scheduled to receive any updates unless a written request is sent to the laboratory's Quality Assurance Department.

QUALITY ASSURANCE / QUALITY CONTROL MANUAL

Approval

5/27/05		Kristin Clay	5-27-05
Operations Manager Approval	Date	Operations Manager Approval	Date
5/27/05		5/27/05	
Operations Manager Approval	Date	Division Manager Approval	Date
5/27/05			
Quality Assurance Officer Approval	Date		

Effective Date	Modification Number (CF13-01.5 mod #)	Description

Section 2.0
TABLE OF CONTENTS

TABLE OF TABLES

TABLE OF FIGURES

Table of Appendices

Section 3.0
Introduction / Policy Statement

The TestAmerica Analytical Testing Corp – Cedar Falls, IA Quality Assurance Manual is a document prepared to define the overall policies, organizational objectives and functional responsibilities for achieving TestAmerica Analytical Testing Corp's data quality goals. Each TestAmerica Analytical Testing Corp location maintains a local perspective in its scope of services and client relations and maintains a national perspective in terms of quality.

3.1 Policy Statement

The management of TestAmerica Analytical Testing Corp is committed to providing high quality and legally defensible data to its clients by adhering to approved methodologies and the QA/QC protocols described in this manual.

It is TestAmerica Analytical Testing Corp's policy to continually improve systems and provide support to quality improvement efforts. The company recognizes that the implementation of a quality assurance program requires management's commitment and support as well as the involvement of the entire laboratory staff.

In this document we define the following terms as follows:

Quality Assurance - The total integrated program for assuring reliability of monitoring and measurement data.

Quality Control - The routine application of procedures for obtaining prescribed standards of performance in the monitoring and measurement process.

Elements of TestAmerica Analytical Testing Corp – Cedar Falls, IA's QA program include:

3.1.1 Standard Operating Procedures (SOPs) for instrumentation, field services, analytical services and applicable administrative systems (QA systems, sample management, data reporting).

3.1.2 A quality control program that includes analysis of blanks, spikes, duplicates, calibration verification and other appropriate Quality Control samples that ensure that data quality objectives are met.

3.1.3 Participation in performance testing (PT) programs such as Water Pollution (WP), Water Supply (WS), Soil, American Industrial Hygiene Association (Air Samples), and various client specified programs.

3.1.4 Internal audit programs to monitor compliance with the Quality Assurance Manual, SOPs and to evaluate performance of analytical methods used in the laboratory.

3.1.5 Maintenance of state and national laboratory accreditations.

3.2 Fields of Testing Covered

The methods specifically covered by this manual include the most frequently requested water, air, industrial waste, and soil methodologies currently needed to provide analytical services in the United States and its territories. The approach of this manual is to define the minimum level of quality assurance and quality control necessary to meet requirements. All methods performed by TestAmerica Analytical Testing Corp – Cedar Falls, IA shall meet these criteria as appropriate. In some instances, quality assurance project plans (QAPPs), project specific data quality objectives (DQOs) or local regulations may require criteria other than those contained in this manual. In these cases the laboratory will abide by the more stringent criteria following review and acceptance of the requirements by the Division Manager, Operations Manager and the Quality Assurance Officer.

The methods not covered in National Environmental Laboratory Accreditation Conference (NELAC) certification include microbiology and air sample analysis. These methods are covered by certification programs other than NELAC. The certifications and methods performed are identified in section 5 of this manual.

3.3 Management of the Manual

The manual has been prepared to include sections addressing the content requirements specified by the 2003 NELAC standards, ANSI/ISO Guide 17025, and QAMS-005/80, Interim Guidelines and Specifications for Preparing Quality Assurance Project Plans USEPA Dec 29, 1980. The outline format is based on the Florida DEP publication outlining Quality Assurance Plan requirements, DEP Manual for Preparing Quality Assurance Plans – DEP-QA-001/90.

3.3.1 Review Process

The manual is reviewed annually by the Quality Assurance Officer and laboratory personnel to assure that it reflects current practices and meets the requirements of TestAmerica Analytical Testing Corp – Cedar Falls, IA clients and regulators. From time to time the manual may need changes in order to meet new or changing regulations and operational changes. The Quality Assurance Officer will review and document the changes in the normal course of business and incorporate changes into revised sections of the document. The updates will be reviewed by the Quality Assurance Officer, Division Manager, Operations Manager, relevant operational staff and the Corporate Director of Quality Assurance and then formally incorporated into the document in periodic updates. The QAM is based on a Corporate QAM template that is prepared and approved by Corporate Director of Quality Assurance. This template is reviewed annually by the Corporate Director of Quality Assurance and each laboratory. Necessary changes are coordinated by the Corporate Director of Quality Assurance and distributed to each laboratory for inclusion in the laboratory specific QA Manuals.

Policies in the QA Manual that require immediate attention may be addressed through the use of Corporate or division specific QA/QC Policy memoranda. QA/QC Policy Memoranda are published from time to time to facilitate immediate changes to QA/QC Policy. QA/QC Policy Memoranda supersede the QA Manual and all other Standard Operating Procedures (see Section 3.3.3). All policy memoranda are dated, archived and distributed by their placement into the front of the QA Manual between the cover page and Section 2. At a minimum, each policy memorandum is approved by the same authorized signatories as shown on the coverpage of the QA Manual. In addition, Corporate QA/QC Policy Memoranda are signed by the President and

Memoranda supersede the QA Manual and all other Standard Operating Procedures (see Section 3.3.3). All policy memoranda are dated, archived and distributed by their placement into the front of the QA Manual between the cover page and Section 2. At a minimum, each policy memorandum is approved by the same authorized signatories as shown on the coverpage of the QA Manual. In addition, Corporate QA/QC Policy Memoranda are signed by the President and the Director of Quality Assurance. The QA/QC Policy memoranda are incorporated into the QA Manual during the periodic updates. An example format can be found in Figure 3-1.

3.3.2 Control

This manual is considered confidential within TestAmerica Analytical Testing Corp and may not be altered in any manner by other than a duly appointed representative from TestAmerica Analytical Testing Corp. If the document has been provided to external users or regulators it is for the exclusive purpose of reviewing TestAmerica Analytical Testing Corp – Cedar Falls, IA's quality systems and shall not be used in any other way without the written permission of an appointed representative of TestAmerica Analytical Testing Corp. The procedure for control of distribution is incorporated by reference to SOP CP01-02: Distribution and Control of Standard Operating Procedures and the QA Manual.

3.3.3 Order of Precedence

In the event of conflict or discrepancy between policies, the order of precedence is as follows:

3.3.3.1 TestAmerica Analytical Testing Corp QA/QC Policy Memorandum – Corporate

3.3.3.2 TestAmerica Analytical Testing Corp QA/QC Policy Memorandum – Division

3.3.3.3 Quality Assurance Manual

3.3.3.4 Corporate SOPs

3.3.3.5 Division SOPs

3.3.3.6 Other (memos, flow charts, etc.)

Figure 3-1

Example Format for a QA/QC Policy Memorandum

Corporate (or Local) QA/QC Policy Memorandum # ______

Effective Date: ____________________________

Corporate: *(Only needed for Corporate Memorandum)*

President	Date	Vice President of Quality Assurance	Date

Local:

Operations Manager Approval	Date	Quality Assurance Officer Approval	Date
Division/Lab Manager Approval	Date	Operations Manager Approval	Date
Operations Manager Approval	Date		

3. **Purpose**

2. **Procedure**

3. **Documentation**

4. **Attachments**

5. References/Cross References

Section 4.0
Organization and Responsibility

4.1 Organization

TestAmerica Analytical Testing Corp – Cedar Falls, IA is part of a national network of laboratories known as TestAmerica Incorporated. This Quality Assurance Manual (QAM) is applicable to the Cedar Falls, IA only. The corporate organization related to the laboratories can be found in Figure 4-1 and the laboratory's organization can be found in Appendix 2. The locations of all TestAmerica Analytical Testing Corp laboratories are as follows:

Cedar Falls Division
704 Enterprise Drive
Cedar Falls, IA 50613
Phone: (319) 277-2401

Nashville Division
2960 Foster Creighton Dr.
Nashville, TN 37204
Phone: (615) 726-0177

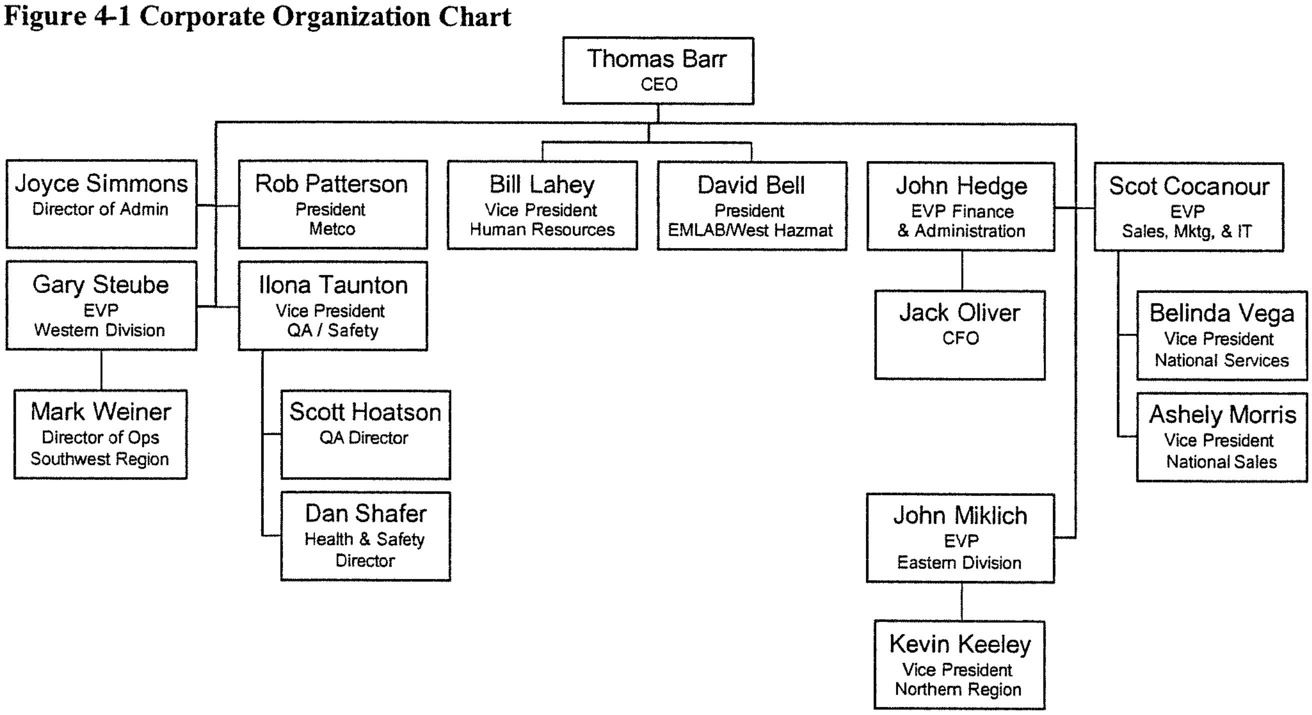
Indianapolis Division
6964 Hillsdale Court
Indianapolis, IN 46250
Phone: (317) 842-4261

Dayton Division
3601 South Bldg. 2848 Suite E
Dayton, OH 45439
Phone: (937) 294 - 6856

Orlando Division
4310 E. Anderson Rd
Orlando, FL 32812
Phone: (407) 851-2560

Watertown Division
602 Commerce Drive
Watertown, WI 53094
Phone: (920) 261-1660

Figure 4-1 Corporate Organization Chart



4.2 Roles and Responsibilities

In order for the Quality Assurance program to function properly, all members of the staff must clearly understand and meet their individual responsibilities as they relate to QA/QC. The following descriptions define each role in its relationship to the quality assurance program. Comprehensive job descriptions are maintained by laboratory management. Every employee has direct access to the Quality Assurance Manual (QAM) and training is provided in order to help each employee apply the QAM to his or her specific responsibilities.

4.2.1 Responsibility for the Quality Assurance Program

The responsibility for quality lies with every employee of TestAmerica Analytical Testing Corp – Cedar Falls, IA. All employees are responsible for knowing the content of this manual and upholding the standards therein. Each person shall carry out his/her daily tasks in a manner consistent with the goals and in accordance with the procedures in this manual and the laboratory's SOPs.

4.2.2 President / Chief Executive Officer (CEO)

The President reports directly to the Board of Directors and is ultimately responsible for the quality and performance of all TestAmerica Incorporated operations. He establishes the overall quality standard for the company and provides the necessary leadership and resources to assure that the standard is met.

4.2.3 Vice President of Quality Assurance

The Director of Quality Assurance reports directly to the President. With the aid of the Division Managers, Laboratory Managers and Quality Assurance Officers, the Director of Quality Assurance has the responsibility for the establishment, general overview, and Corporate maintenance of the quality assurance program within TestAmerica Analytical Testing Corp. Additional responsibilities of the Director of Quality Assurance include:

4.2.3.1 Review of QA/QC aspects of Corporate SOPs, national projects and expansions or changes in services.

4.2.3.2 Coordination/preparation of the Corporate QA Manual Template that is used by each laboratory to prepare their own Division specific QAM.

4.2.3.3 Oversight of the QA/QC programs within each laboratory. This occurs through a final review of each Division or Laboratory specific QAM prior to finalization and by receiving a copy of each laboratory's QA monthly report.

4.2.3.4 Participation, when requested, in the hiring of laboratory Quality Assurance staff.

4.2.3.5 Maintenance of an archive for laboratory QA Manuals, Corporate Quality Policy memorandums and Corporate SOPs.

4.2.3.6 Assisting laboratories with certification activities.

4.2.4 Division Manager

TestAmerica Analytical Testing Corp – Cedar Falls, IA's Division Manager is responsible for the overall quality, financial, technical, human resource and service performance of the entire laboratory and reports directly to Vice President of Northern Operations. The Division Manager provides the resources necessary to implement and maintain an effective and comprehensive quality assurance program. In the absence of the Division Manager, the Operations Manager designated by the Division Manager fulfills the Division Manager's responsibilities. Specific responsibilities include, but are not limited to:

4.2.4.1 Provides technical guidance to the analytical staff. The Division Manager may be the source point for technical help or designate an individual(s) to fill this role. A Division Manager may appoint one or more technical directors for the appropriate fields of testing. The name(s) of the technical director will be included in the national database.

If the technical director is absent for a period of time exceeding 15 consecutive calendar days, the Division Manager must designate another full time staff member meeting the qualifications of the Technical Director to temporarily perform this function. If the absence exceeds 65 consecutive calendar days, the primary accrediting authority must be notified in writing.

4.2.4.2 Ensures that all analysts and supervisors have the appropriate education and training to properly carry out the duties assigned to them and ensures that this training has been documented.

4.2.4.3 Ensures that personnel are free from any commercial, financial and other undue pressures, which might adversely affect the quality of their work. This is primarily accomplished by ensuring the workload is adequately assessed (see Section 7.1) and distributed. Analyst and Technician compensation is not based either on the number of samples analyzed or quality control samples analyzed within established limits and by ensuring personnel are aware of their responsibilities as specified in the ethics policy (see Appendix 1).

4.2.4.4 Ensure TestAmerica Analytical Testing Corp human resource policies are adhered to and maintained.

4.2.4.5 Ensures that appropriate corrective actions are taken to address analyses identified as requiring such actions by internal and external performance or procedural audits. Procedures that do not meet the standards set forth in the QAM or laboratory SOPs may be temporarily suspended by the Division Manager.

4.2.4.6 Reviews and approves all SOPs prior to their implementation and ensures all approved SOPs are implemented and adhered to.

4.2.4.7 Establishes and maintains a laboratory information system for tracking all samples in the laboratory and utilizes the system to ensure all sample holding times are met.

4.2.4.8 Pursues and maintains appropriate laboratory certification and contract approvals.

4.2.4.9 Reviews and approves data reports prior to their release to the clients. Ensures client specific reporting and quality control requirements are met.

4.2.4.10 Assumes the responsibilities of the QAO in the temporary absence of the QAO.

4.2.5 Quality Assurance Officer (QAO)

The QAO works with laboratory management to ensure that systems are maintained to produce data that is technically sound, legally defensible and of consistent quality in line with the laboratory's QAM and Standard Operating Procedures (SOPs).

The QAO reports directly to the Division Manager. The Vice President of Quality Assurance may be used as a resource in dealing with regulatory requirements, certifications and other quality assurance related items. The QAO has direct access to the Technical Director within the laboratory. Specific responsibilities include, but are not limited to:

4.2.5.1 Serve as the focal point for QA/QC and be responsible for the oversight and/or review of Quality Control Data.

4.2.5.2 Maintain and update the laboratory specific QAM. Ensure that the manual accurately reflects the procedures of the laboratory.

4.2.5.3 Maintain laboratory certifications.

4.2.5.4 Arranges for the analysis of Performance Testing samples necessary to satisfy certification requirements.

4.2.5.5 Monitor and communicate regulatory changes that may affect the laboratory to laboratory management, marketing and the Corporate Director of Quality Assurance.

4.2.5.6 Training and advising the laboratory staff on quality assurance/quality control procedures that are pertinent to their daily activities.

4.2.5.7 Have functions independent from laboratory operations for which he/she has quality assurance oversight.

4.2.5.8 Have a general knowledge of the analytical test methods for which data audit/review is performed (and/or have the means of getting this information when needed).

4.2.5.9 Arrange for and conduct internal audits.

4.2.5.10 Notify laboratory management of deficiencies in the quality system and ensure corrective action is taken. Procedures that do not meet the standards set forth in the QAM or laboratory SOPs must be temporarily suspended or restricted following the procedures outlined in Section 13 (Corrective Action).

4.2.6 Operation Manager(s)/Supervisor(s)

Operations Manager(s)/Supervisors report directly to the Division Manager and are responsible for ensuring that valid data are produced from those analyses within their departments.

TestAmerica Analytical Testing Corp - Cedar Falls Division has 3 Operations Managers (Inorganic/Microbiology, Organics, and IH/Field Services). Responsibilities may include:

4.2.6.1 Ensure MDLs (Method Detection Limit study) are determined for every instrument, matrix, and method.

4.2.6.2 Monitoring standards of performance in quality control and quality assurance.

4.2.6.3 Monitoring the validity of the analyses performed and data generated in the laboratory to assure reliable data.

4.2.6.4 Ensuring that sufficient numbers of qualified personnel are employed to supervise and perform the work of the laboratory.

4.2.6.5 Provide training direction to laboratory staff.

4.2.6.6 Monitor production efforts of the lab. Look for ways to enhance production and improve quality through technical advances and improved LIMS utilization.

4.2.6.7 Coordinate and review preparation of all test method Standard Operating Procedures.

4.2.6.8 Supervise analysts in their department to ensure adherence to applicable SOPs and the QA Manual.

4.2.6.9 Ensure that all analysts in their group receive proper training and that training is documented following the procedures outlined in Section 8.

4.2.6.10 Schedules sample analyses to ensure holding times and project due dates are met.

4.2.6.11 Provide technical guidance to analysts in resolving analytical or instrument-related problems encountered during sample preparation and/or analysis. Technical guidance is also provided to Project Coordinators and the Quality Assurance Officer.

4.2.6.12 Review or ensure review of all logbooks used by their department to document standard preparation, sample analysis, instrument maintenance and repair and other quality control activities outlined in this manual.

4.2.6.13 Report all nonconformance, QC failures, and other problems with potential impact on data quality to the Quality Assurance Officer, Project Coordinator and to the Division Manager (when appropriate).

4.2.6.14 Ensure preventive maintenance is performed on the instruments as outlined in the QAM (Section 10) or SOPs.

4.2.6.15 Maintain adequate inventory of standards, reagents and other materials required for the performance of routine analyses.

4.2.6.16 Assist the Division Manager with LIMS updates.

4.2.6.17 Supervise Client Services Representative.

4.2.6.18 Reviews and approves data reports prior to their release to the clients. Ensures client specific reporting and quality control requirements are met.

4.2.7 Project Manager / Project Coordinator

The Project Coordinator reports directly to the operations manager and serves as a liaison between the laboratory and its clients. The project manager / project coordinator's responsibilities may include:

4.2.7.1 Coordinate subcontract work.

4.2.7.2 Ensure client specifications are met by communicating project and quality assurance requirements to the laboratory.

4.2.7.3 Notify laboratory personnel of incoming projects and sample delivery schedules.

4.2.7.4 Monitor the status of all projects in-house to ensure timely delivery of reports.

4.2.7.5 Inform clients of project-related problems, resolving service issues and coordinating technical issues with the laboratory staff.

4.2.7.6 Coordinate client requests for sample containers and other services.

4.2.7.7 Schedule sample pick-ups from client offices or project sites and notifying the laboratory staff of incoming samples.

4.2.7.8 Review laboratory data reports, quotes and sample log-in sheets.

4.2.7.9 Reviews and approves data reports prior to their release to the clients. Ensures client specific reporting and quality control requirements are met.

4.2.8 Laboratory Analysts and Technicians

Laboratory analysts and technicians are responsible for conducting analysis and performing all tasks assigned to them by the Operations Managers and the Division Manager. The responsibilities of the analysts and technicians are listed below:

4.2.8.1 Perform analyses by adhering to analytical and quality control protocols prescribed by SOPs, this QA Manual and project specific Quality Assurance Project Plan (QAPP).

4.2.8.2 Document standard and sample preparation, instrument calibration and maintenance, data calculations and any observed nonconformance.

4.2.8.3 Report all out-of-control situations, instrument problems, matrix problems and QC failures, which might affect the reliability of the data, to the Operations Manager.

4.2.8.4 Initiate corrective actions or seek technical assistance from Operations Managers.

4.2.8.5 Perform 100% review of the data generated prior to entering and submitting for secondary level review. Perform peer review of data as appropriate.

4.2.8.6 Maintain control charts as appropriate to monitor analytical performance.

4.2.8.7 Ensure sample analysis is completed within specified hold times or immediately inform the Operations Manager if a hold time will not be met.

4.2.8.8 Suggest method improvements to the Operations Manager and the Quality Assurance Officer. These improvements, if approved, will be incorporated into the SOPs.

4.2.9 Safety Officer

The Safety Officer reports to the Division Manager and ensures that systems are maintained for the safe operation of the laboratory. The Safety Officer's responsibilities are outlined below:

4.2.9.1 Conduct ongoing, necessary safety training and conduct new employee safety orientation.

4.2.9.2 Administer dispersal of all Material Safety Data Sheet (MSDS) information.

4.2.9.3 Perform regular chemical hygiene and housekeeping instruction.

4.2.9.4 Give instruction on proper labeling and practice

4.2.9.5 Serve as chairperson of the laboratory safety committee.

4.2.9.6 Ensure appropriately trained personnel and personal protective equipment (PPE) is available as needed.

4.2.9.7 Oversee the inspection and maintenance of personal safety equipment (PPE) – fire extinguishers, safety showers, eyewash fountains, etc. and ensures prompt repairs as needed.

4.2.9.8 Supervise and schedule fire drills and emergency evacuation drills.

4.2.9.9 Determine what initial and subsequent exposure monitoring, if necessary to determine potential employee exposure to chemicals used in the laboratory.

4.2.9.10 When determined necessary, conduct exposure monitoring assessments.

4.2.9.11 Determine when a complaint of possible over-exposure is "reasonable" and should be referred for medical consultation.

4.2.9.12 Assist in the internal and external coordination of the medical consultation / monitoring program conducted by TestAmerica Analytical Testing Corp's medical consultants.

4.2.10 Hazardous Waste Officer

The Hazardous Waste Officer reports to the Division Manager and ensures that hazardous waste operations are maintained to local, state and federal regulations. The Hazardous Waste Officer's responsibilities are outlined below:

4.2.10.1 Loads, unloads, or handles hazardous materials.

4.2.10.2 Prepares hazardous materials for transportation.

4.2.10.3 Responsible for the safety of transporting hazardous materials.

4.2.10.4 Ensures that individuals in connection with preparing materials for transport have met the necessary training requirements.

4.2.10.5 Performs weekly audits of the Hazardous Waste Program.

4.2.10.6 Organize and retain all information related to the shipment of hazardous waste.

4.2.11 Office Manager

The Office Manager reports to the Division Manager. The responsibilities of the Office Manager are outlined below:

4.2.11.1 Supervise administrative personnel.

4.2.11.2 Prepare and distribute client invoices and other billing information

4.2.11.3 Provide quotations to clients for analytical services

4.2.11.4 Coordinates laboratory and office supply purchasing

4.2.11.5 Maintains office supplies, inventory and ordering

4.2.11.6 Files and maintains laboratory reports, invoices and other customer information.

4.2.12 Client Services Representative

The Clients Services Representative reports to the Operation Manager and serves as the interface between the laboratory's technical departments and the laboratory's clients. The responsibilities of the Client Services Representative are outlined below:

4.2.12.1 Assist clients in procuring the proper sampling supplies.

4.2.12.2 Respond to client inquiries concerning sample status.

4.2.12.3 Assist clients with resolution of problems concerning Chain-of-Custody.

4.2.12.4 Provide quotations to clients for analytical services.

4.2.12.5 Resolution of discrepancies between client samples and Chain-of-Custody.

4.2.13 Field Services Technic ian

The Field Services Technician reports to the Operation Manager. The responsibilities of the Field Services Technician are outlined below:

4.2.13.1 Perform sample collection and sample pick-up.

4.2.13.2 Ensure sample containers and Industrial Hygiene (IH) media are prepared for sampling events and assist in shipping sample containers to clients.

4.2.13.3 Perform field tests and measurements and operate and maintain equipment used for those purposes.

4.3 Education and Experience Requirements for Technical Personnel

The following are the education/experience requirements for laboratory technical personnel. Records of relevant qualifications, training, skills and experience of the technical personnel are maintained by the laboratory (see Section 8 – Analytical Procedures).

4.3.1 Divis ion Manager – A bachelor's degree in science is required. If a bachelor's degree is in a field other than chemistry, the individual should have the number of credit hours in chemistry equivalent to a minor in chemistry.

4.3.2 Technical Director/Operation Manager – A bachelor's degree in the chemical, environmental, biological sciences or engineering, with at least 24 college semester credit hours in chemistry and at least two years of experience in the environmental analysis of representative inorganic and organic analytes for which the laboratory seeks or maintains accreditation. A master's or doctoral degree in one of the above disciplines may be substituted for one year of experience.

A person with an associate's degree in the appropriate field of the sciences or applied sciences, with a minimum of four college semester credit hours in general microbiology may be the technical director of a laboratory engaged in microbiological analysis limited to fecal coliform, total coliform and standard plate count. Two years of equivalent and successful college education, including the microbiology requirement, may be substituted for the associate's degree. In addition, each person shall have one year of experience in environmental analysis.

4.3.3 Quality Assurance Officer– A bachelor's degree in basic or applied science and at least 1 year of nonacademic analytical chemistry, or in lieu of a degree, 4 years of nonacademic analytical chemistry experience. In addition, documented training in statistics or quality control procedures is required.

4.3.4 Analyst – An analyst must possess a high school diploma or equivalent. If the analyst operates ICP or GC/MS equipment, the analyst must satisfactory complete a short course offered by an equipment manufacturer, professional organization, university or other qualified training facility (formal in-house training is acceptable). A minimum experience requirement for the operation of AA, ICP and GC is six months; 1 year for GC/MS equipment. The analyst must follow training and documentation as summarized in Section 8.

4.4 Physical Facilities

4.4.1 Environment

4.4.4.1 Laboratory accommodation, test areas, energy sources, lighting, heating and ventilation must be adequate to facilitate proper performance of tests.

4.4.4.2 The environment in which these activitie s are undertaken shall not invalidate the results or adversely affect the required accuracy of measurement

4.4.4.3 The laboratory shall provide for the effective monitoring, control and recording of environmental conditions as appropriate. Such environmental conditions may include biological sterility, dust electromagnetic interference, humidity, mains voltage, temperature, and sound and vibration levels.

4.4.4.4 In instances where monitoring or control of any of the above mentioned items is specified in a test method or by regulation, the laboratory shall meet and document adherence to the laboratory facility requirements.

4.4.2 Work Areas

4.4.2.1 There shall be effective separation between neighboring areas when the activities therein are incompatible including culture handling or incubation areas and volatile organic chemicals handling areas.

4.4.2.2 Access to and use of all areas affecting the quality of these activities shall be defined and controlled.

4.4.2.3 Adequate measures shall be taken to ensure good housekeeping in the laboratory and to ensure that any contamination does not adversely affect data quality.

4.4.2.4 Work areas must be available to ensure an unencumbered work area. Work areas include:

a) Access and entryways to the laboratory
b) Sample receipt areas
c) Sample storage areas
d) Chemical and waste storage areas
e) Data handling and storage areas
f) Analytical testing areas

4.4.3 Floor Plan

A floor plan can be found in Appendix 3.

4.4.4 Building Security

4.4.4.1 Each visitor to the laboratory must sign in and out in a visitor's logbook.

4.4.4.2 The laboratory maintains a contract with Reliable Systems of Waterloo, IA for building alarm services. The alarm code and building keys are distributed to a limited number of essential laboratory personnel.

4.4.4.3 Signs are posted within the laboratory to limit access to non-laboratory personnel.

Section 5.0
QA Objectives for the Measurement of Data

The TestAmerica Analytical Testing Corp – Cedar Falls, IA quality assurance objectives are described in terms of precision, accuracy, representativeness, comparability and completeness. Criteria for data quality indicators such as matrix spikes, laboratory control samples and duplicate sample precision are specified in this section. Analyte reporting limits are also included.

5.1 Precision

The laboratory objective for precision is to meet the precision demonstrated for these analytical methods on similar samples and to meet data for these analyses published by the US EPA. Precision is defined as the degree of reproducibility of measurements under a given set of analytical conditions (exclusive of field sampling variability). Precision is documented on the basis of replicate analysis, usually duplicate or matrix spike duplicate samples.

5.2 Accuracy

The laboratory objective for accuracy is to meet the performance for accuracy demonstrated for these analytical methods on similar samples and to meet the recovery data published by the US EPA. Accuracy is defined as the degree of bias in a measurement system. Accuracy is documented on the basis of recovery of matrix spikes. Accuracy may also be documented through the use of laboratory control samples. A statement of accuracy is expressed as an interval of acceptance recovery about the mean recovery.

5.3 Representativeness

The laboratory objective for representativeness is to provide data which is representative of the sampled medium. Representativeness is defined as the degree to which data represent a characteristic of a population or set of samples and is measurement of both analytical and field sampling precision. The representativeness of the analytical data is a function of the procedures used in procuring and processing the samples. The representativeness can be documented by the relative percent difference between separately procured, but otherwise identical samples or sample aliquots.

The representativeness of the data from the sampling sites depends on both the sampling procedures and the analytical procedures. The laboratory can assist the customer with enacting proper sampling and handling methods in order to assure the integrity of the samples.

5.4 Comparability

The comparability objective is to provide analytical data for which the accuracy, precision, representativeness and reporting limit statistics are similar to these quality indicators generated:

5.4.1 by other laboratories for similar samples, and

5.4.2 data generated by TestAmerica Analytical Testing Corp – Cedar Falls, IA over time.

The comparability objective is documented by inter-laboratory studies carried out by regulatory agencies or carried out for specific projects or contracts, by comparison of periodically generated statements of accuracy, precision and reporting limits with those of other laboratories, and by the degree to which approval from the US EPA or other pertinent regulatory agencies is obtained for any procedure for which significant modifications have been made.

5.5 Completeness

The completeness objective for data is 90% (or as specified by a particular project), expressed as the ratio of the valid data to the total data over the course of the project. Data will be considered valid if they are adequate for their intended use. Data usability will be defined in a QAPP, project scope or regulatory requirement. Data validation is the process for reviewing data to determine its usability and completeness. If the completeness objective is not met, actions will be taken internally and with the data user to improve performance. This may take the form of an audit to evaluate the methodology and procedures as possible sources for the difficulty or may result in a recommendation to use a different method.

5.6 Criteria for Quality Indicators

Tables 5-1 through 5-17 summarize the precision and accuracy acceptability limits for analyses performed at TestAmerica Analytical Testing Corp – Cedar Falls, IA. Unless otherwise noted, limits within these tables are laboratory generated. Some acceptability limits are derived from US EPA methods when they are provided. Where US EPA method limits are not provided, TestAmerica Analytical Testing Corp – Cedar Falls, IA has developed limits from evaluation of data from similar matrices. Acceptability of QC will be determined as compared to these tables. Data may be accepted where QC falls outside these limits if probable cause can be attributed to the matrix and laboratory control samples (LCS) show that the method is in control. Deviations are documented in the final report to the client. In instances where an LCS limit is not available, a limit of 70 – 130% recovery is acceptable until in-house limits can be generated (Note: Ensure that an alternative default limit is not available in a published method). In some cases, lower default limits may be set with the quality assurance officer and technical director's approval. In the absence of in house or method defined limits, the following guidelines are used to determine interim limits for matrix spike and matrix spike/matrix spike duplicates: MS: 70-130%, MS/MSD: 20% RPD. Some compounds may need to be wider based on prior knowledge of the compound (e.g. Phenols by SW 8270).

5.7 Statistically Derived Limits

Statistically derived precision and accuracy limits are required by selected methods and programs. TestAmerica Analytical Testing Corp –Cedar Falls, IA will routinely utilize statistically derived limits to evaluate method performance and determine when corrective action is appropriate. The laboratory periodically updates the limits as stated in this manual. If the statistically derived limits are too wide for practical use in the laboratory (standard deviation > 15), an administrative limit will be enforced (± 45% of the mean value). The analysts are instructed to use the current limits posted in the laboratory (dated and approved by the Technical Director and QA Officer) and entered into the Laboratory Information Management System (LIMS). The Quality Assurance Officer maintains an archive of all limits used within the laboratory. These statistically calculated limits are equal to or tighter than the limits displayed in this QAM. If limits need to be adjusted outside of the limits in this QAM, the QAM would be updated.

5.8 Certifications

State	Certification ID:
Iowa	007
Wisconsin	999917270
Minnesota	0019-999-319

NELAC	Certification ID:
Oregon	IA100001
Kansas	E-10341
Illinois	200024

National	Certification ID:
AIHA	285
Other Affiliations	
ACIL	308

Table 5-1
Analytical Methods and Quality Assurance Objectives
Drinking Water

Parameter (Table 5-1: Drinking Water)	**Method Reference**	**Precision (RPD)**	**Matrix Accuracy (%R)**	**LCS ACCURACY (%R)**	**MDL**	**RL**
Alkalinity	SM 2320B	≤10	80-125	NA	0.74 mg/L	5.0 mg/L
Corrosivity (Langelier Saturation Index)	SM 2330 B	NA	NA	NA	NA	NA
Cyanide	EPA 335.4	≤20	90-110	90-110	0.0012 mg/L	0.010 mg/L
Fluoride	SM 4500 F,C	≤10	75-125	75-125	0.044 mg/L	0.20 mg/L
Hardness	EPA 130.2	≤10	85-125	NA	2.7 mg/L	5.0 mg/L
	SM 2340 B	NA	NA	NA	NA	7.0 mg/L
Nitrate-Nitrite	SM 4500-NO_3 E	≤20	75-125	NA	0.025 mg/L	0.10 mg/L
Nitrate	SM 4500NO_3 E	≤20	75-125	NA	0.025 mg/L	0.10 mg/L
	SM 4500NO_3 D	≤10	75-125	NA	0.084 mg/L	1.0 mg/L
Nitrite	SM 4500 NO_3 E	≤20	75-125	NA	0.024 mg/L	0.10 mg/L
pH (pH units)	EPA 150.1	≤0.1	NA	NA	NA	0.1 pH units
Silica	SM 4500 Si D	≤15	75-125	NA	0.26 mg/L	0.50 mg/L
Specific Conductance	SM 2510 B	≤10	NA	NA	0.28µmhos/cm	1.0 µmhos/cm
Sulfate	SM 4500-SO_4 E	≤15	75-125	NA	3.0 mg/L	10 mg/L
Total Dissolved Solids	SM 2540 C	≤15	NA	90-110	13.5 mg/L	20 mg/L
Turbidity (N.T.U.s)	EPA 180.1	≤20	NA	NA	0.12 NTU	1 NTU

NA – Not applicable
RL – Reporting Limit
MDL – Method Detection Limit

Table 5-2
Analytical Methods and Quality Assurance Objectives
for Metals in Drinking Water

Parameter (Table 5-2: Metals in Drinking Water)	**Method Reference**	**Matrix Precision (RPD)**	**Matrix Accuracy (%R)**	**LCS Accuracy (%R)**	**MDL (mg/L)**	**RL (mg/L)**
Antimony as Sb	EPA 200.9	≤10	75-125	85-115	0.0021	0.0060
Arsenic as As	EPA 200.9	≤10	80-125	85-115	0.00052	0.0010
Barium as Ba	EPA 200.7	≤10	75-120	80-110	0.0008	0.010
Cadmium as Cd	EPA 200.9	≤10	75-125	85-115	0.00014	0.0005
Calcium	EPA 200.7	≤10	70-130	85-115	0.020	1.0
Chromium as Cr	EPA 200.7	≤10	80-115	85-110	0.0048	0.020
	EPA 200.9	≤10	75-125	85-115	0.00020	0.0020
Copper as Cu	EPA 200.7	≤10	85-115	85-110	0.0014	0.020
Lead as Pb	EPA 200.9	≤10	75-125	85-115	0.00070	0.0040
Mercury as Hg	EPA 245.2	≤10	50-145	80-125	0.000017	0.00020

RL – Reporting Limit
MDL – Method Detection Limit

Parameter (Table 5-2: Metals in Drinking Water)	**Method Reference**	**Matrix Precision (RPD)**	**Matrix Accuracy (%R)**	**LCS Accuracy (%R)**	**MDL (mg/L)**	**RL (mg/L)**
Silver as Ag	EPA 200.7	≤10	75-125	85-105	0.0035	0.020
	EPA 200.9	≤10	75-125	85-115	0.00006	0.0010
Selenium as Se	EPA 200.9	≤10	40-135	85-115	0.0018	0.0050
Sodium as Na	EPA 200.7	≤10	40-135	85-120	0.047	1.0
Thallium as Tl	EPA 200.9	≤10	75-125	85-115	0.00062	0.0020

RL – Reporting Limit
MDL – Method Detection Limit

Table 5-3
Analytical Methods and Quality Assurance Objectives for Microbiological Examination of Drinking Water

Parameter (Table 5-3: Microbiological Examination of Drinking Water)	**Method Reference**	**Precision (RPD)**	**Matrix Accuracy (%R)**	**LCS ACCURACY (%R)**	**Default Reporting Limit**
Total Coliform (MF)	SM 9222 B	NA	NA	NA	NA
Total Coliform/E Coli	9223 B - PA	NA	NA	NA	NA

NA- Not Applicable

Table 5-4
Analytical Methods and Quality Assurance Objectives for Field Measurement Parameters for Drinking Water

Parameter (Table 5-4: Field Measurements Parameters for Drinking Water)	**Method Reference**	**Precision (RPD)**	**Matrix Accuracy (%R)**	**LCS ACCURACY (%R)**	**MDL**	**RL**
pH (pH units)	EPA 150.1	≤0.1	NA	NA	NA	NA
Specific Conductance (μmhos)	SM 2510 B	≤10	NA	NA	0.28μmhos/cm	1.0 μmhos/cm
Temperature (°C)	EPA 170.1	NA	NA	NA	NA	NA
Turbidity (N.T.U.s)	EPA 180.1	≤20	NA	NA	0.12 NTU	1 NTU

ND- Not Determined

Table 5-5
Analytical Methods and Quality Assurance Objectives Surface Water, Groundwater, and Wastewater Effluents

Parameter (Table 5-5: Surface Water, Groundwater, and Wastewaster)	**Method Reference**	**Matrix Precision (RPD)**	**Matrix Accuracy (%R)**	**LCS Accuracy (%R)**	**MDL**	**RL**
Acidity	SM 2310 B	≤20	NA	NA	NA	5.0 mg/L
Alkalinity, Total	SM 2320B	≤10	80-125	NA	0.74 mg/L	5.0 mg/L
Ammonia Nitrogen	SM4500-NH3 B,E	≤20	75-125	90-115	0.26 mg/L	0.50 mg/L
	SM 4500-NH3 F	≤10	75-125	NA	0.047 mg/L	0.20 mg/L
	EPA 350.1	≤10	90-110	NA	0.047 mg/L	0.20 mg/L
BOD 5 Day	SM 5210 B	≤20	NA	85-115	0.67 mg/L	3.0 mg/L
CBOD 5 Day	SM 5210 B	≤20	NA	85-115	0.67 mg/L	3.0 mg/L
COD	SM 5220 D	≤20	75-125	NA	8.5 mg/L	25 mg/L
COD, LL	SM 5220 D	≤15	75-125	NA	1.7 mg/L	5.0 mg/L

RL – Reporting Limit
MDL – Method Detection Limit

Parameter (Table 5-5: Surface Water, Groundwater, and Wastewaster)	**Method Reference**	**Matrix Precision (RPD)**	**Matrix Accuracy (%R)**	**LCS Accuracy (%R)**	**MDL (mg/L)**	**RL (mg/L)**
Chloride	SM 4500-Cl C	≤15	75-125	NA	1.3 mg/L	5.0mg/L
	SM 4500-Cl E	≤10	90-110	NA	0.53 mg/L	5.0 mg/L
Chlorine, Total Residual	EPA 330.5	≤20	NA	NA	0.026 mg/L	0.10 mg/L
Color (Pt-Co units)	SM 2120 B	≤20	NA	NA	NA	APHA
Corrosivity (Langelier Saturation Index)	SM 2330 B	NA	NA	NA	NA	NA
Specific Conductance	SM 2510 B	≤10	NA	NA	0.28µmhos/cm	1.0 µmhos/cm
Cyanide, Amenable to Chlorination	EPA 335.1	≤20	90-110	90-110	0.0015 mg/L	0.010 mg/L
Cyanide, Total	EPA 335.4	≤20	90-110	90-110	0.0012 mg/L	0.010 mg/L
	EPA 335.3	≤20	90-110	90-110	0.0012 mg/L	0.010 mg/L
	SW 9012	≤20	92-110	90-110	0.0012 mg/L	0.010 mg/L
Dissolved Oxygen	EPA 360.1	≤20	NA	NA	NA	1.0 mg/L
Fluoride	SM 4500-F B,C	≤15	75-125	80-115	0.13 mg/L	1.0 mg/L
	SM 4500-F C	≤10	75-125	NA	0.044 mg/L	0.20 mg/L
Hardness, Calcium	EPA 215.2	≤10	75-125	NA	1.8 mg/L	5.0 mg/L
Hardness, Total	EPA 130.2	≤10	85-125	NA	2.7 mg/L	5.0 mg/L
	SM 2340 B	NA	NA	NA	NA	7.0 mg/L
Nitrate-Nitrite	SM4500-NO3 D	≤10	75-125	NA	0.067 mg/L	1.0 mg/L
	SM4500-NO3 E	≤20	75-125	NA	0.025 mg/L	0.10 mg/L
	EPA 353.3	≤20	75-125	NA	0.025 mg/L	0.10 mg/L
Nitrate Nitrogen	SM4500-NO3 D	≤10	75-125	NA	0.084 mg/L	1.0 mg/L
	SW 9210	≤10	75-125	NA	0.084 mg/L	1.0 mg/L
	SM4500-NO3 E	≤20	75-125	NA	0.025 mg/L	0.10 mg/L
	EPA 353.3	≤20	75-125	NA	0.025 mg/L	0.10 mg/L
Nitrite Nitrogen	EPA 354.1	≤20	75-125	90-110	0.024 mg/L	0.10 mg/L
Organic Nitrogen	EPA 351.2-350.2	≤20	NA	NA	NA	1.0 mg/L
Total Kjeldahl Nitrogen (TKN)	EPA 351.2	≤15	90-110	90-110	0.10 mg/L	1.0 mg/L
Oil & Grease	EPA 1664 A	≤18	78-114	78-114	1.0 mg/L	5.0 mg/L
pH (pH units)	EPA 150.1	≤0.1	NA	NA	NA	NA
	SW 9040 B	≤0.1	NA	NA	NA	NA
	SW 9045 C	≤0.1	NA	NA	NA	NA
Phenols, 4AAP	EPA 420.2	≤20	90-110	90-110	0.0022 mg/L	0.020 mg/L
Phosphate, Ortho	EPA 365.1	≤20	90-110	NA	0.022 mg/L	0.10 mg/L
Phosphorous, Total	EPA 365.1	≤15	90-110	NA	0.0056 mg/L	0.10 mg/L
Total Solids	SM 2540 B	≤15	NA	90-110	8.3 mg/L	20 mg/L
Dissolved Solids	SM 2540 C	≤15	NA	90-110	13.5 mg/L	20 mg/L

NA – Not Applicable
RL – Reporting Limit
MDL – Method Detection Limit

Parameter (Table 5-5: Surface Water, Groundwater, and Wastewaster)	**Method Reference**	**Matrix Precision (RPD)**	**Matrix Accuracy (%R)**	**LCS Accuracy (%R)**	**MDL (mg/L)**	**RL (mg/L)**
Dissolved Fixed Solids	SM 2540 E	≤20	NA	NA	NA	10 mg/L
Suspended Solids	USGS I-3765-85	≤20	NA	80-110	0.66 mg/L	3.0 mg/L
Suspended Fixed Solids	SM 2540 E	≤20	NA	NA	NA	3 mg/L
Settleable Residue	SM 2540 F	≤15	NA	NA	NA	0.10 mL/L
Settleable Residue (30 min)	SM 2540 F	≤15	NA	NA	NA	0.10 mL/L
Sulfate	SM 4500-SO_4 E	≤15	75-125	NA	3.0 mg/L	10 mg/L
	ASTM D516-90	≤20	75-125	NA	3.6 mg/L	10 mg/L
Sulfide	EPA 376.1	≤20	NA	30-125	NA	1.0 mg/L
Silica	SM 4500-Si D	≤15	75-125	NA	0.26 mg/L	0.50 mg/L
Temperature (°C)	SM 2550 B	NA	NA	NA	NA	NA
Volatile Solids	SM 2540 E	≤20	NA	NA	NA	5 mg/L
	160.4	≤20	NA	NA	NA	10 mg/L
Turbidity (N.T.U.s)	EPA 180.1	≤20	NA	NA	0.12 NTU	1 NTU
Total Organic Carbon	SM 5310 C	≤20	75-125	NA	0.31 mg/L	1.0 mg/L
	SW 9060	≤20	75-125	NA	0.31 mg/L	1.1 mg/L
Total Organic Halides	SW 9020 B	≤20	70-130	70-130	0.0043 mg/L	0.010 mg/L

NA – Not Applicable
RL – Reporting Limit
MDL – Method Detection Limit

Table 5-6
Analytical Methods and Quality Assurance Objectives
Metals in Surface Water, Groundwater, and Wastewater Effluents

Parameter (Table 5-6: Metals in Surface Water, Groundwater, and Wastewater Effluents)	**Method Reference**	**Matrix Precision (RPD)**	**Matrix Accuracy (%R)**	**LCS Accuracy (%R)**	**MDL (mg/L)**	**RL (mg/L)**
Aluminum as Al	EPA 200.7	≤10	75-125	85-110	0.014	0.10
	SW 6010B	≤10	75-125	85-110	0.014	0.10
Antimony as Sb	EPA 200.7	≤10	85-115	85-110	0.024	0.10
	SW 6010B	≤10	85-115	85-110	0.024	0.027
	SW 7041	≤15	75-125	90-115	0.0032	0.0060
	EPA 204.2	≤15	75-125	90-115	0.0032	0.0060
Arsenic as As	EPA 200.7	≤10	85-120	85-115	0.068	0.080
	SW 6010B	≤10	85-120	85-115	0.068	0.080
	SW 7060	≤20	75-125	80-120	0.00053	0.0010
	EPA 206.2	≤20	75-125	80-120	0.0011	0.0050
Barium as Ba	EPA 200.7	≤10	75-120	80-110	0.0008	0.010
	SW 6010B	≤10	75-120	80-110	0.0008	0.010

RL – Reporting Limit
MDL – Method Detection Limit

Parameter (Table 5-6: Metals in Surface Water, Groundwater, and Wastewater Effluents)	**Method Reference**	**Matrix Precision (RPD)**	**Matrix Accuracy (%R)**	**LCS Accuracy (%R)**	**MDL (mg/L)**	**RL (mg/L)**
Beryllium as Be	EPA 200.7	≤10	90-115	85-110	0.00076	0.010
	SW 6010B	≤10	90-115	85-110	0.00076	0.010
	SW 7091	≤20	80-120	80-120	0.00011	0.0010
	EPA 210.2	≤20	80-120	80-120	0.00011	0.0010
Boron	SW 6010B	≤10	75-125	85-110	0.058	0.10
	EPA 200.7	≤10	75-125	85-110	0.058	0.10
Cadmium as Cd	EPA 200.7	≤10	80-115	85-110	0.0024	0.020
	SW 6010B	≤10	80-115	85-110	0.0024	0.020
	SW 7131	≤20	75-125	80-120	0.00018	0.0005
	EPA 213.2	≤20	75-125	80-120	0.00018	0.0005
Calcium as Ca	EPA 200.7	≤10	75-125	85-115	0.020	1.0
	SW 6010B	≤10	75-125	85-115	0.020	1.0
Chromium as Cr	EPA 200.7	≤10	80-115	85-110	0.0027	0.020
	SW 6010B	≤10	80-115	85-110	0.0027	0.020
	SW 7191	≤10	75-125	80-110	0.00025	0.0020
	EPA 218.2	≤10	75-125	80-110	0.00025	0.0020
Chromium, Hexavalent	SM 3500-Cr D	≤20	75-125	NA	0.0020	0.020
Cobalt as Co	SW 6010B	≤10	80-110	85-110	0.0048	0.020
	EPA 200.7	≤10	80-110	85-110	0.0048	0.020
Copper as Cu	SW 6010B	≤10	85-115	85-110	0.0014	0.020
	EPA 200.7	≤10	85-115	85-110	0.0014	0.020
	SW 7211	≤20	75-125	80-115	0.00074	0.0050
	EPA 220.2	≤20	75-125	80-115	0.00074	0.0050
Indium as In	SW 6010B	≤20	75-125	90-110	0.022	0.50
	EPA 200.7	≤20	75-125	90-110	0.022	0.50
Iron as Fe	SW 6010B	≤10	75-125	85-110	0.017	0.10
	EPA 200.7	≤10	75-125	85-110	0.017	0.10
Lead as Pb	SW 6010B	≤10	80-115	85-110	0.031	0.10
	EPA 200.7	≤10	80-115	85-110	0.031	0.10
	SW 7421	≤20	75-125	80-120	0.0016	0.0040
	EPA 239.2	≤20	75-125	80-120	0.0016	0.0040
Lithium as Li	SW 6010B	≤20	75-125	85-115	0.0075	0.050
	EPA 200.7	≤20	75-125	85-115	0.0075	0.050
Magnesium as Mg	SW 6010B	≤10	75-125	85-115	0.018	1.0
	EPA 200.7	≤10	75-125	85-115	0.018	1.0
Manganese as Mn	SW 6010B	≤10	75-125	85-110	0.0013	0.010
	EPA 200.7	≤10	75-125	85-110	0.0013	0.010

RL – Reporting Limit
MDL – Method Detection Limit

Parameter (Table 5-6: Metals in Surface Water, Groundwater, and Wastewater Effluents)	**Method Reference**	**Matrix Precision (RPD)**	**Matrix Accuracy (%R)**	**LCS Accuracy (%R)**	**MDL (mg/L)**	**RL (mg/L)**
Mercury as Hg	SW 7470 A	≤10	75-125	80-120	0.000017	0.00020
	EPA 245.2	≤10	75-125	80-120	0.000017	0.00020
Molybdenum as Mo	SW 6010B	≤10	90-110	85-110	0.013	0.050
	EPA 200.7	≤10	90-110	85-110	0.013	0.050
	SW 7481	≤20	75-125	85-120	0.0019	0.010
	EPA 246.2	≤20	75-125	85-120	0.0019	0.010
Nickel as Ni	SW 6010B	≤10	80-110	85-110	0.010	0.050
	EPA 200.7	≤10	80-110	85-110	0.010	0.050
	EPA 249.2	≤20	75-125	80-120	0.0020	0.010
	SW 7521	≤20	75-125	80-120	0.0020	0.010
Potassium as K	SW 6010 B	≤10	70-130	85-115	0.038	1.0
	EPA 200.7	≤10	70-130	85-115	0.038	1.0
Selenium as Se	SW 6010B	≤10	80-120	85-110	0.065	0.15
	EPA 200.7	≤10	80-120	85-110	0.065	0.15
	SW 7740	≤50	75-125	85-115	0.0022	0.0050
	EPA 270.2	≤50	75-125	85-115	0.0022	0.0050
Silver as Ag	SW 6010B	≤20	75-125	85-105	0.0035	0.020
	EPA 200.7	≤20	75-125	85-105	0.0035	0.020
	SW 7761	≤20	75-125	80-110	0.00006	0.0010
	EPA 272.2	≤20	75-125	80-110	0.00006	0.0010
Sodium as Na	SW 6010B	≤10	75-125	85-115	0.047	1.0
	EPA 200.7	≤10	75-125	85-115	0.047	1.0
Strontium as Sr	SW 6010B	≤10	85-120	85-110	0.009	0.1
	EPA 200.7	≤10	85-120	85-110	0.009	0.1
Thallium as Tl	SW 6010B	≤10	75-110	85-110	0.049	1.0
	EPA 200.7	≤10	75-110	85-110	0.049	1.0
	SW 7841	≤20	75-125	80-110	0.00061	0.0020
	EPA 279.2	≤20	75-125	80-110	0.00061	0.0020
Tin as Sn	SW 6010B	≤10	75-125	90-110	0.036	0.10
	EPA 200.7	≤10	75-125	90-110	0.036	0.10
Titanium as Ti	EPA 200.7	≤20	75-125	85-110	0.0018	0.050
	SW 6010 B	≤20	75-125	85-110	0.0018	0.050
Vanadium as V	SW 6010B	≤10	90-110	90-110	0.0082	0.050
	EPA 200.7	≤10	90-110	90-110	0.0082	0.050
Zinc as Zn	SW 6010B	≤35	75-125	85-110	0.0029	0.020
	EPA 200.7	≤35	75-125	85-110	0.0029	0.020

RL – Reporting Limit
MDL – Method Detection Limit

Table 5-7
Analytical Methods and Quality Assurance Objectives
Extractable Organics in Surface Water, Groundwater and Wastewater Effluents

Parameter (Table 5-7: Extractable Organics in Surface Water, Groundwater, and Wastewater Effluents)	**Method Reference**	**Matrix Precision (RPD)**	**Matrix Accuracy (%R)**	**LCS Accuracy (%R)**	**MDL (µg/L)**	**RL (µg/L)**
Semi-Volatiles by GC/MS						
Acenaphthene	EPA 625, SW 8270 C	≤35	10-90	35-120	2.4	10
Acenaphthylene	EPA 625, SW 8270 C	≤35	10-90	30-115	2.2	10
Anthracene	EPA 625, SW 8270 C	≤35	10-95	35-125	2.1	10
Benzidine	EPA 625, SW 8270 C	≤35	10-70	10-75	3.0	100
Benzoic Acid	EPA 625, SW 8270 C	≤35	10-65	10-50	1.5	20
Benzo(a)anthracene	EPA 625, SW 8270 C	≤35	10-95	40-130	2.4	10
Benzo(b)fluoranthene	EPA 625, SW 8270 C	≤35	10-95	40-135	2.5	10
Benzo(k)fluoranthene	EPA 625, SW 8270 C	≤35	10-95	40-130	2.3	10
Benzo(ghi)perylene	EPA 625, SW 8270 C	≤35	10-95	40-135	2.0	10
Benzo(a)pyrene	EPA 625, SW 8270 C	≤35	10-95	40-130	2.0	10
Benzyl alcohol	EPA 625, SW 8270 C	≤35	10-85	30-95	1.4	10
Butyl benzyl phthalate	EPA 625, SW 8270 C	≤35	10-100	50-115	2.9	10
Bis(2-Chloroethoxy)methane	EPA 625, SW 8270 C	≤35	10-90	35-100	2.3	10
Bis(2-Chloroethyl)ether	EPA 625, SW 8270 C	≤35	10-90	35-95	2.4	10
Bis(2-chloroisopropyl)ether	EPA 625, SW 8270 C	≤35	10-95	35-95	2.4	10
Bis(2-ethylhexyl)phthalate	EPA 625, SW 8270 C	≤35	10-100	50-120	6.9	5.0
4-Bromophenylphenyl ether	EPA 625, SW 8270 C	≤35	10-95	45-120	2.2	10
Carbazole	EPA 625, SW 8270 C	≤35	10-95	30-125	2.1	10
4-Chloroaniline	EPA 625, SW 8270 C	≤35	10-85	15-100	2.5	10
4-Chloro-3-methylphenol	EPA 625, SW 8270 C	≤33	10-100	40-115	2.3	10
2-Chloronaphthalene	EPA 625, SW 8270 C	≤35	10-90	35-105	2.3	10

[1] – Default Limits used until lab generated limits can be determined
RL – Reporting Limit
MDL – Method Detection Limit

Parameter (Table 5-7: Extractable Organics in Surface Water, Groundwater, and Wastewater Effluents)	**Method Reference**	**Matrix Precision (RPD)**	**Matrix Accuracy (%R)**	**LCS Accuracy (%R)**	**MDL (µg/L)**	**RL (µg/L)**
2-Chlorophenol	EPA 625, SW 8270 C	≤35	10-90	35-100	2.3	10
4-Chlorophenylphenyl ether	EPA 625, SW 8270 C	≤35	10-95	45-115	2.4	10
Chrysene	EPA 625, SW 8270 C	≤35	10-85	40-130	2.2	10
Dibenzo(a,h)anthracene	EPA 625, SW 8270 C	≤35	10-100	40-135	1.3	10
Dibenzofuran	EPA 625, SW 8270 C	≤35	10-95	40-115	2.5	10
1,2-Dichlorobenzene	EPA 625, SW 8270 C	≤35	10-85	30-90	2.3	10
1,3-Dichlorobenzene	EPA 625, SW 8270 C	≤35	10-85	25-90	2.3	10
1,4-Dichlorobenzene	EPA 625, SW 8270 C	≤35	10-85	30-90	2.4	10
3,3'-Dichlorobenzidine	EPA 625, SW 8270 C	≤35	10-80	25-120	2.6	50
2,4-Dichlorophenol	EPA 625, SW 8270 C	≤35	10-95	40-105	2.0	10
Diethyl phthalate	EPA 625, SW 8270 C	≤35	10-95	45-115	2.1	10
2,4-Dimethylphenol	EPA 625, SW 8270 C	≤35	10-90	20-95	1.8	10
Dimethyl phthalate	EPA 625, SW 8270 C	≤35	10-95	45-115	2.3	10
Di-n-butyl phthalate	EPA 625, SW 8270 C	≤35	10-95	50-120	3.0	10
Di-n-octyl phthalate	EPA 625, SW 8270 C	≤35	10-100	50-120	3.4	10
2,4-Dinitrophenol	EPA 625, SW 8270 C	≤35	10-95	15-110	1.1	20
2,5-Dinitrophenol	EPA 625, SW 8270 C	≤35	10-100	25-120	2.0	10
2,4-Dinitrotoluene	EPA 625, SW 8270 C	≤35	10-95	45-120	2.3	10
2,6-Dinitrotoluene	EPA 625, SW 8270 C	≤35	10-105	45-120	2.1	10
1,2-Diphenylhydrazine	EPA 625, SW 8270 C	≤35	10-90	35-125	1.2	10
Fluoranthene	EPA 625, SW 8270 C	≤35	10-95	40-130	2.3	10
Fluorene	EPA 625, SW 8270 C	≤35	10-95	40-125	2.5	10
Hexachlorobenzene	EPA 625, SW 8270 C	≤35	10-95	45-120	2.3	10
Hexachlorobutadiene	EPA 625, SW 8270 C	≤35	10-80	20-90	2.0	10

[1] – Default Limits used until lab generated limits can be determined
RL – Reporting Limit
MDL – Method Detection Limit

Parameter (Table 5-7: Extractable Organics in Surface Water, Groundwater, and Wastewater Effluents)	**Method Reference**	**Matrix Precision (RPD)**	**Matrix Accuracy (%R)**	**LCS Accuracy (%R)**	**MDL (µg/L)**	**RL (µg/L)**
Hexachlorocyclopentadiene	EPA 625, SW 8270 C	≤35	10-80	10-95	1.1	20
Hexachloroethane	EPA 625, SW 8270 C	≤35	10-85	25-85	2.1	10
Indeno(1,2,3-cd)pyrene	EPA 625, SW 8270 C	≤35	10-100	40-135	2.3	10
Isophorone	EPA 625, SW 8270 C	≤35	10-90	40-105	2.4	10
2-Methyl-4,6-dinitrophenol	EPA 625, SW 8270 C	≤35	10-100	25-120	2.0	10
1-Methylnaphthalene	EPA 625, SW 8270 C	≤35	10-90	35-100	2.4	10
2-Methylnaphthalene	EPA 625, SW 8270 C	≤35	10-90	35-100	2.2	10
2-Methylphenol (o-cresol)	EPA 625, SW 8270 C	≤35	10-85	30-90	1.8	10
4-Methylphenol (p-cresol)	EPA 625, SW 8270 C	≤35	10-80	25-90	1.3	10
Naphthalene	EPA 625, SW 8270 C	≤35	10-85	30-100	2.2	10
2-Nitroaniline	EPA 625, SW 8270 C	≤35	25-120	35-130	2.4	10
3-Nitroaniline	EPA 625, SW 8270 C	≤35	10-100	30-125	2.5	10
4-Nitroaniline	EPA 625, SW 8270 C	≤35	10-90	35-130	2.5	10
Nitrobenzene	EPA 625, SW 8270 C	≤35	10-90	40-100	2.4	10
2-Nitrophenol	EPA 625, SW 8270 C	≤35	10-95	35-110	2.5	10
4-Nitrophenol	EPA 625, SW 8270 C	≤32	10-75	10-70	1.0	10
N-Nitrosodi-n-butylamine	EPA 625, SW 8270 C	≤35	10-95	45-105	2.6	10
N-Nitrosodiethylamine	EPA 625, SW 8270 C	≤35	10-90	40-95	2.6	10
N-Nitrosodimethylamine	EPA 625, SW 8270 C	≤35	10-80	15-80	1.3	10
N-Nitrosodi-n-propylamine	EPA 625, SW 8270 C	≤35	10-90	40-100	2.6	10
N-Nitrosodiphenylamine	EPA 625, SW 8270 C	≤35	10-95	30-120	2.6	10
N-Nitrosopyrrolidine	EPA 625, SW 8270 C	≤35	10-90	40-100	2.0	10
Pentachlorophenol	EPA 625, SW 8270 C	≤35	10-105	30-125	4.1	10
Pentachlorobenzene	EPA 625, SW 8270 C	≤35	10-95	40-115	2.3	10

[1] – Default Limits used until lab generated limits can be determined
RL – Reporting Limit
MDL – Method Detection Limit

Parameter (Table 5-7: Extractable Organics in Surface Water, Groundwater, and Wastewater Effluents)	**Method Reference**	**Matrix Precision (RPD)**	**Matrix Accuracy (%R)**	**LCS Accuracy (%R)**	**MDL (µg/L)**	**RL (µg/L)**
Phenanthrene	EPA 625, SW 8270 C	≤35	10-95	40-125	2.4	10
Phenol	EPA 625, SW 8270 C	≤35	10-60	10-60	2.0	10
Pyrene	EPA 625, SW 8270 C	≤35	10-95	40-125	2.1	10
Pyridine	EPA 625, SW 8270 C	≤35	10-75	10-75	1.3	10
1,2,4,5-Tetrachlorobenzene	EPA 625, SW 8270 C	≤35	10-85	35-100	2.2	10
Total Cresols	EPA 625, SW 8270 C	≤35	10-85	30-90	1.8	10
1,2,4-Trichlorobenzene	EPA 625, SW 8270 C	≤35	10-85	30-95	2.3	10
2,4,5-Trichlorophenol	EPA 625, SW 8270 C	≤30	10-105	40-120	2.6	10
2,4,6-Trichlorophenol	EPA 625, SW 8270 C	≤35	10-100	40-120	2.6	10
Surrogates						
2,4,6-Tribromophenol	EPA 625, SW 8270 C	NA	NA	45-140	NA	NA
p-Terphenyl-d14	EPA 625, SW 8270 C	NA	NA	35-130	NA	NA
2-Fluorobiphenyl	EPA 625, SW 8270 C	NA	NA	30-120	NA	NA
Nitrobenzene-d5	EPA 625, SW 8270 C	NA	NA	35-110	NA	NA
2-Fluorophenol	EPA 625, SW 8270 C	NA	NA	10-75	NA	NA
Phenol-d6	EPA 625, SW 8270 C	NA	NA	10-60	NA	NA
PAH – Polynuclear Aromatic Hydrocarbons by 8270 SIMS						
Acenaphthene	SW 8270 C SIM	≤20	19-109	19-109	0.016	0.10
Acenaphthylene	SW 8270 C SIM	≤20	23-113	23-113	0.018	0.10
Anthracene	SW 8270 C SIM	≤20	20-110	20-110	0.019	0.10
Benzo(a)anthracene	SW 8270 C SIM	≤20	52-142	52-142	0.021	0.10
Benzo(b)fluoranthene	SW 8270 C SIM	≤20	67-157	67-157	0.026	0.10
Benzo(k)fluoranthene	SW 8270 C SIM	≤20	53-143	53-143	0.027	0.10
Benzo(ghi)perylene	SW 8270 C SIM	≤20	11-101	11-101	0.016	0.10
Benzo(a)pyrene	SW 8270 C SIM	≤20	49-139	49-139	0.022	0.10
Chrysene	SW 8270 C SIM	≤20	40-130	40-130	0.019	0.10
Dibenzo(a,h)anthracene	SW 8270 C SIM	≤20	13-103	13-103	0.017	0.10
Fluoranthene	SW 8270 C SIM	≤20	38-128	38-128	0.021	0.10
Fluorene	SW 8270 C SIM	≤20	20-110	20-110	0.015	0.10
Indeno(1,2,3-cd)pyrene	SW 8270 C SIM	≤20	16-106	16-106	0.015	0.10

RL – Reporting Limit
MDL – Method Detection Limit

Parameter (Table 5-7: Extractable Organics in Surface Water, Groundwater, and Wastewater Effluents)	**Method Reference**	**Matrix Precision (RPD)**	**Matrix Accuracy (%R)**	**LCS Accuracy (%R)**	**MDL (µg/L)**	**RL (µg/L)**
Naphthalene	SW 8270 C SIM	≤20	19-109	19-109	0.021	0.10
Phenanthrene	SW 8270 C SIM	≤20	30-120	30-120	0.019	0.10
Pyrene	SW 8270 C SIM	≤20	37-127	37-127	0.015	0.10
Surrogates						
2-Fluorobiphenyl	SW 8270 C SIM	NA	NA	21-111	NA	NA
Nitrobenzene-d5	SW 8270 C SIM	NA	NA	30-120	NA	NA
p-Terphenyl-d14	SW 8270 C SIM	NA	NA	31-121	NA	NA

PAH – Polynuclear Aromatic Hydrocarbons by HPLC

Acenaphthene	SW 8310	≤35	39-129	41-115	0.13	0.19
Acenaphthylene	SW 8310	≤35	39-129	39-115	0.17	0.19
Anthracene	SW 8310	≤35	30-120	25-103	0.0093	0.19
Benzo(a)anthracene	SW 8310	≤35	38-128	39-114	0.019	0.13
Benzo(b)fluoranthene	SW 8310	≤35	36-126	35-122	0.037	0.10
Benzo(k)fluoranthene	SW 8310	≤35	36-126	34-124	0.023	0.14
Benzo(ghi)perylene	SW 8310	≤35	24-114	21-111	0.032	0.10
Benzo(a)pyrene	SW 8310	≤35	33-123	23-113	0.019	0.19
Chrysene	SW 8310	≤35	40-130	42-120	0.020	0.10
Dibenzo(a,h)anthracene	SW 8310	≤35	19-109	15-105	0.033	0.10
Fluoranthene	SW 8310	≤35	42-132	44-115	0.032	0.19
Fluorene	SW 8310	≤35	42-132	39-119	0.029	0.19
Indeno(1,2,3-cd)pyrene	SW 8310	≤35	29-119	26-116	0.038	0.10
1-Methylnaphthalene	SW 8310	≤20	30-120	30-120	0.12	0.19
2-Methylnaphthalene	SW 8310	≤20	30-120	30-120	0.12	0.19
Naphthalene	SW 8310	≤35	39-129	41-116	0.10	0.10
Phenanthrene	SW 8310	≤35	45-135	45-112	0.015	0.10
Pyrene	SW 8310	≤35	41-131	36-117	0.036	0.19
Surrogate						
2-Fluorobiphenyl	SW 8310	NA	38-115	38-115	NA	NA

RL – Reporting Limit
MDL – Method Detection Limit

Table 5-8
Analytical Methods and Quality Assurance Objectives
Extractable Hydrocarbons and PCB's in Wastewater, Groundwater, and Wastewater Effluents

Parameter (Table 5-8: Extractable Hydrocarbons and PCB's in Wastewater, Groundwater, and Wastewater Effluents)	Method Reference	Matrix Precision (RPD)	Matrix Accuracy (%R)	LCS Accuracy (%R)	MDL (µg/L)	RL (µg/L)
Polychlorinated Biphenyls (PCBs)						
PCB-1016	EPA 608	≤20	14 – 104	14 – 104	0.10	0.2
	SW 8082	≤20	14 – 104	14 – 104	0.10	1.0
PCB-1221	EPA 608	≤20	28 – 118	28 – 118	0.490	0.2
	SW 8082	≤20	28 – 118	28 – 118	0.490	1.0
PCB-1232	EPA 608	≤20	20 – 110	20 – 110	0.027	0.2
	SW 8082	≤20	20 – 110	20 – 110	0.027	1.0
PCB-1242	EPA 608	≤20	20 – 110	20 – 110	0.085	0.2
	SW 8082	≤20	20 – 11	20 – 110	0.085	1.0
PCB-1248	EPA 608	≤20	19 – 109	19 – 109	0.065	0.2
	SW 8082	≤20	19 – 109	19 – 109	0.065	1.0
PCB-1254	EPA 608	≤20	28 – 118	28 – 118	0.098	0.2
	SW 8082	≤20	28 – 118	28 – 118	0.098	1.0
PCB-1260	EPA 608	≤20	29 – 119	29 – 119	0.091	0.2
	SW 8082	≤20	29 – 119	29 – 119	0.091	1.0
PCB-1268	EPA 608	≤20	29 – 119	29 – 119	0.095	0.2
	SW 8082	≤20	29 – 119	29 – 119	0.095	1.0
Surrogates						
Tetrachloro-m-xylene	EPA 608	NA	NA	22 – 112	NA	NA
	SW 8082	NA	NA	22 – 112	NA	NA
Decachlorobiphenyl	EPA 608	NA	NA	10 – 100	NA	NA
	SW 8082	NA	NA	10 – 100	NA	NA
Extractable Hydrocarbons						
Diesel	OA-2	≤35	70-130[1]	50 – 125	67.2	380
Gasoline	OA-2	≤35	70-130[1]	30 - 120	162	380
Motor Oil	OA-2	≤35	70-130[1]	20 - 95	168	380
Surrogates						
N-Octacosane	OA-2	NA	NA	55 - 150	NA	NA

[1] – Default Limits used until lab generated limits can be determined
RL – Reporting Limit
MDL – Method Detection Limit

Table 5-9
Analytical Methods and Quality Assurance Objectives For Purgeable Volatile Organics in Surface Water, Groundwater, and Wastewater Effluents

Parameter (Table 5-9: Purgeable Volatile Organics in Surface Water, Goundwater and Wastewater Effluents)	**Method Reference**	**Matrix Precision (RPD)**	**Matrix Accuracy (%R)**	**LCS Accuracy (%R)**	**MDL (µg/L)**	**RL (µg/L)**
Volatiles by GC/MS						
Acetone	EPA 624, SW 8260 B	≤30	20-115	40-135	0.65	20
Acrolein	EPA 624, SW 8260 B	≤20	70-130	50-145	5.56	10
Acrylonitrile	EPA 624, SW 8260 B	≤25	50-145	60-135	0.73	10
Benzene	EPA 624, SW 8260 B	≤15	60-135	70-135	0.10	0.5
Bromobenzene	EPA 624, SW 8260 B	≤20	55-140	70-135	0.20	1.0
Bromochloromethane	EPA 624, SW 8260 B	≤35	45-140	65-130	0.28	5.0
Bromodichloromethane	EPA 624, SW 8260 B	≤35	45-140	65-125	0.12	1.0
Bromoform	EPA 624, SW 8260 B	≤15	40-135	55-125	0.27	5.0
Bromomethane	EPA 624, SW 8260 B	≤35	30-125	30-125	1.32	4.0
2-Butanone(MEK)	EPA 624, SW 8260 B	≤35	60-150	65-160	0.70	10
Carbon disulfide	EPA 624, SW 8260 B	≤35	40-135	65-135	0.32	1.0
Carbon tetrachloride	EPA 624, SW 8260 B	≤30	25-120	50-135	0.24	2.0
Chlorobenzene	EPA 624, SW 8260 B	≤15	50-140	65-130	0.11	1.0
Chloroethane	EPA 624, SW 8260 B	≤35	50-145	60-150	0.35	4.0
2-Chloroethyl vinyl ether	EPA 624, SW 8260 B	≤35	10-40	15-110	1.90	2.0
2-Chlorotoluene	EPA 624, SW 8260 B	≤20	45-135	65-130	0.13	1.0
Chloroform	EPA 624, SW 8260 B	≤30	45-140	70-130	0.16	1.0
Chloromethane	EPA 624, SW 8260 B	≤35	35-130	40-135	0.37	3.0

[1] – Default Limits used until lab generated limits can be determined
RL – Reporting Limit
MDL – Method Detection Limit

Parameter (Table 5-9: Purgeable Volatile Organics in Surface Water, Goundwater and Wastewater Effluents)	**Method Reference**	**Matrix Precision (RPD)**	**Matrix Accuracy (%R)**	**LCS Accuracy (%R)**	**MDL (µg/L)**	**RL (µg/L)**
4-Chlorotoluene	EPA 624, SW 8260 B	≤25	45-140	65-130	0.17	1.0
Cyclohexane	EPA 624, SW 8260 B	≤35	35-130	70-145	0.21	10
1,1-Dichloroethane	EPA 624, SW 8260 B	≤15	60-130	70-130	0.16	1.0
1,1-Dichloroethene	EPA 624, SW 8260 B	≤20	45-135	70-135	0.21	2.0
1,1-Dichloropropene	EPA 624, SW 8260 B	≤15	35-130	60-140	0.43	1.0
Dibromochloromethane	EPA 624, SW 8260 B	≤30	50-135	65-125	0.29	5.0
1,2-cis-Dichloroethene	EPA 624, SW 8260 B	≤35	45-140	70-130	0.18	1.0
1,2-Dibromo-3-chloropropane	EPA 624, SW 8260 B	≤25	45-140	35-130	0.81	10
1,2-Dibromoethane(EDB)	EPA 624, SW 8260 B	≤10	50-145	65-130	0.17	10
1,2-Dichlorobenzene	EPA 624, SW 8260 B	≤20	50-145	65-130	0.11	1.0
1,2-Dichloroethane	EPA 624, SW 8260 B	≤10	55-135	65-135	0.16	1.0
1,2-Dichloropropane	EPA 624, SW 8260 B	≤35	45-140	65-130	0.18	1.0
1,2-trans-Dichloroethene	EPA 624, SW 8260 B	≤15	50-135	70-130	0.23	1.0
Dibromomethane	EPA 624, SW 8260 B	≤15	70-130	65-130	0.20	1.0
Dichlorodifluoromethane	EPA 624, SW 8260 B	≤25	25-120	40-135	0.23	3.0
1,3-cis-Dichloropropene	EPA 624, SW 8260 B	≤20	40-130	55-120	0.15	5.0
1,3-Dichlorobenzene	EPA 624, SW 8260 B	≤20	50-145	65-130	0.14	1.0
1,3-Dichloropropane	EPA 624, SW 8260 B	≤25	50-145	70-135	0.30	1.0
1,3-trans-Dichloropropene	EPA 624, SW 8260 B	≤25	35-120	50-115	0.15	5.0
1,4-Dichlorobenzene	EPA 624, SW 8260 B	≤15	45-140	65-130	0.17	1.0
2,2-Dichloropropane	EPA 624, SW 8260 B	≤25	30-125	40-135	0.52	4.0
Di-Isopropyl ether	EPA 624, SW 8260 B	≤15	60-135	70-130	0.27	1.0
Ethanol	EPA 624, SW 8260 B	≤35	55-145	40-135	76.99	1000
Ethylbenzene	EPA 624, SW 8260 B	≤15	50-135	65-130	0.44	1.0

RL – Reporting Limit
MDL – Method Detection Limit

Parameter (Table 5-9: Purgeable Volatile Organics in Surface Water, Goundwater and Wastewater Effluents)	**Method Reference**	**Matrix Precision (RPD)**	**Matrix Accuracy (%R)**	**LCS Accuracy (%R)**	**MDL (µg/L)**	**RL (µg/L)**
Heptane	EPA 624, SW 8260 B	≤25	35-130	45-140	0.32	10
2-Hexanone	EPA 624, SW 8260 B	≤30	35-130	40-135	0.55	10
Hexachlorobutadiene	EPA 624, SW 8260 B	≤35	35-130	45-135	0.39	5.0
Hexane	EPA 624, SW 8260 B	≤35	25-120	45-135	0.33	1.0
Iodomethane	EPA 624, SW 8260 B	≤35	30-125	35-130	0.33	10
4-Isopropyltoluene	EPA 624, SW 8260 B	≤15	50-135	65-130	0.14	1.0
Isopropylbenzene	EPA 624, SW 8260 B	≤15	45-135	65-130	0.15	1.0
m&p-Xylene	EPA 624, SW 8260 B	≤20	45-135	70-135	0.24	2.0
4-Methyl-2-pentanone (MIBK)	EPA 624, SW 8260 B	≤15	50-145	55-130	0.47	10
Methyl acetate	EPA 624, SW 8260 B	≤25	50-135	60-145	1.34	100
2-Methylpentane	EPA 624, SW 8260 B	≤20	70-130[1]	70-130[1]	-	10
Methylene chloride	EPA 624, SW 8260 B	≤15	60-140	70-135	0.40	5.0
Methyl-t-butyl ether	EPA 624, SW 8260 B	≤25	55-150	60-140	0.14	1.0
Naphthalene	EPA 624, SW 8260 B	≤35	60-150	45-115	0.33	5.0
n-Butyl benzene	EPA 624, SW 8260 B	≤15	35-130	60-125	0.13	1.0
n-Propylbenzene	EPA 624, SW 8260 B	≤35	50-135	65-130	0.13	1.0
o-Xylenes	EPA 624, SW 8260 B	≤30	45-140	65-130	0.16	1.0
sec-Butyl benzene	EPA 624, SW 8260 B	≤15	50-135	65-130	0.16	1.0
Styrene	EPA 624, SW 8260 B	≤25	35-130	65-130	0.20	1.0
t-Amylmethyl ether	EPA 624, SW 8260 B	≤15	55-145	55-150	0.11	10
t-Butanol	EPA 624, SW 8260 B	≤35	50-145	40-135	2.40	100
t-Butylethyl ether	EPA 624, SW 8260 B	≤20	55-145	55-150	0.13	10
tert-Butyl benzene	EPA 624, SW 8260 B	≤15	35-130	65-130	0.12	1.0
Tetrahydrofuran	EPA 624, SW 8260 B	≤35	50-145	45-140	4.86	50

[1] – Default Limits used until lab generated limits can be determined
RL – Reporting Limit
MDL – Method Detection Limit

Parameter (Table 5-9: Purgeable Volatile Organics in Surface Water, Goundwater and Wastewater Effluents)	**Method Reference**	**Matrix Precision (RPD)**	**Matrix Accuracy (%R)**	**LCS Accuracy (%R)**	**MDL (µg/L)**	**RL (µg/L)**
Tetrachloroethene	EPA 624, SW 8260 B	≤35	50-135	70-130	0.21	5.0
1,1,1,2-Tetrachloroethane	EPA 624, SW 8260 B	≤10	45-140	60-125	0.19	1.0
1,1,1-Trichloroethane	EPA 624, SW 8260 B	≤10	40-135	60-135	0.20	1.0
1,1,2,2-Tetrachloroethane	EPA 624, SW 8260 B	≤15	60-145	65-130	0.15	1.0
1,1,2-Trichloroethane	EPA 624, SW 8260 B	≤35	50-145	65-130	0.22	1.0
1,1,2-Trichlorofluoroethane	EPA 624, SW 8260 B	≤25	35-130	65-135	0.23	1.0
Toluene	EPA 624, SW 8260 B	≤15	60-130	70-135	0.09	1.0
1,3,5-Trimethylbenzene	EPA 624, SW 8260 B	≤25	35-130	65-130	0.15	1.0
trans-1,4-Dichloro-2-butene	EPA 624, SW 8260 B	≤35	10-90	35-130	0.47	10
Trichloroethene	EPA 624, SW 8260 B	≤25	50-130	65-130	0.17	1.0
Trichlorofluoromethane	EPA 624, SW 8260 B	≤15	40-135	65-135	0.20	4.0
1,2,3-Trichlorobenzene	EPA 624, SW 8260 B	≤35	55-150	50-125	0.33	1.0
1,2,3-Trichloropropane	EPA 624, SW 8260 B	≤15	55-150	55-125	0.38	1.0
1,2,4-Trichlorobenzene	EPA 624, SW 8260 B	≤25	50-145	60-120	0.29	5.0
1,2,4-Trimethylbenzene	EPA 624, SW 8260 B	≤30	35-130	65-130	0.16	1.0
Vinyl acetate	EPA 624, SW 8260 B	≤30	25-120	40-135	1.19	2.0
Xylenes, Total	EPA 624, SW 8260 B	≤30	45-135	65-130	0.24	2.0
Vinyl chloride	EPA 624, SW 8260 B	≤15	40-135	60-135	0.26	1.0

Surrogates

Dibromofluoromethane	EPA 624, SW 8260 B	NA	NA	70-130	NA	NA
4-Bromofluorobenzene	EPA 624, SW 8260 B	NA	NA	70-130	NA	NA
Toluene-d8	EPA 624, SW 8260 B	NA	NA	70-130	NA	NA

RL – Reporting Limit
MDL – Method Detection Limit

Parameter (Table 5-9: Purgeable Volatile Organics in Surface Water, Goundwater and Wastewater Effluents)	Method Reference	Matrix Precision (RPD)	Matrix Accuracy (%R)	LCS Accuracy (%R)	MDL (µg/L)	RL (µg/L)
BTEX by GC (FID)						
Benzene	OA-1, SW 8015	≤20	50-120	50-115	0.06	2.0
Ethyl Benzene	OA-1, SW 8015	≤10	75-115	75-115	0.233	2.0
Methyl-tert-butyl ether (MTBE)	OA-1, SW 8015	≤20	40-130	40-130	0.263	5.0
Toluene	OA-1, SW 8015	≤15	70-110	70-110	0.079	2.0
1,2,4-Trimethylbenzene	OA-1, SW 8015 B	≤20	70-130[1]	70-130[1]	NA	2.0
1,3,5-Trimethylbenzene	OA-1, SW 8015 B	≤20	70-130[1]	70-130[1]	NA	2.0
Total Purgable Hydrocabons (TPH)[2]	OA-1, SW 8015	≤20	70-130[1]	70-125	0.0241	0.10
Total Xylene	OA-1, SW 8015	≤25	70-115	75-115	0.311	3.0
Surrogate						
4-Bromofluorobenzene	OA-1, SW 8015	NA	NA	70-125	NA	NA
BTEX by GC (PID)						
Benzene	OA-1, SW 8021	≤20	50-120	50-120	0.32	1.0
Ethyl Benzene	OA-1, SW 8021	≤10	75-115	75-115	0.22	1.0
Methyl-tert-butyl ether (MTBE)	OA-1, SW 8021	≤20	40-130	40-130	0.96	20
Toluene	OA-1, SW 8021	≤15	70-110	70-110	0.32	1.0
1,2,4-Trimethylbenzene	OA-1, SW 8021	≤20	70-130[1]	70-130[1]	NA	2.0
1,3,5-Trimethylbenzene	OA-1, SW 8021	≤20	70-130[1]	70-130[1]	NA	2.0
Total Xylenes	OA-1, SW 8021	≤25	70-115	75-115	0.43	3.0
Surrogate						
4-Bromofluorobenzene	SW 8021 OA-1, SW 8021	NA	NA	70-125	NA	NA

[1] – Default Limits used until lab generated limits can be determined
RL – Reporting Limit
MDL – Method Detection Limit

Table 5-10
Analytical Methods and Quality Assurance Objectives for Microbiological Examination of Surface Water, Groundwater, and Wastewater Effluents

Parameter (Table 5-10: Microbiological Examination of Surface Water, Groundwater and Wastewater Effluents)	**Method Reference**	**Matrix Precision (RPD)**	**Matrix Accuracy (%R)**	**LCS Accuracy (%R)**	**Default Reporting Limits**
Fecal Coliform	SM 9221 E A-1	NA	NA	NA	2 col/100mL
Fecal Coliform (MF)	SM 9222 D	NA	NA	NA	10 col/100mL

NA – Not Applicable

Table 5-11
Analytical Methods and Quality Assurance Objectives for Field Measurement Parameters in Surface Waters, Groundwater, and Wastewater Effluents

Parameter (Table 5-11: Field Measurement in Surface Waters, Groundwater, and Wastewater Effluents)	**Method Reference**	**Matrix Precision (RPD)**	**Matrix Accuracy (%R)**	**LCS Accuracy (%R)**	**MDL**	**RL**
Chlorine, Free Residual	SM 4500-Cl G	NA	NA	NA	NA	0.10 mg/L
Chlorine, Total Residual	SM 4500-Cl G	NA	NA	NA	NA	0.10 mg/L
Dissolved Oxygen	HACH HRDO	NA	NA	NA	NA	1.0 mg/L
pH (pH units)	EPA 150.1	NA	NA	NA	NA	NA
Specific Conductance (µmhos)	SM2510 B	NA	NA	NA	NA	1 µmhos/cm
Temperature (°C)	SM 2550 B	NA	NA	NA	NA	NA

NA – Not Applicable
RL – Reporting Limit
MDL – Method Detection Limit

Table 5-12
Analytical Methods and Quality Assurance Objectives For Sediments, Soils, Residuals, and Hazardous Waste

Parameter (Table 5-12) Sediments, Soils, Residuals, and Hazardous Waste	**Method Reference**	**Matrix Precision (RPD)**	**Matrix Accuracy (%R)**	**LCS Accuracy (%R)**	**MDL**	**RL**
Acidity	SM 2310 B	≤35	NA	NA	NA	NA
Alkalinity	SM 2320 B	≤35	75-125	NA	NA	NA
Ammonia	SM 4500-NH_3 B,E	≤12	75-125	89-111	NA	50 mg/Kg
Chloride	SM-4500-Cl C	≤35	75-125	NA	NA	50 mg/Kg
COD	SM 5220 D	≤35	75-125	NA	NA	NA
Cyanide	SW 9012	≤20	90-110	90-110	0.11 mg/Kg	1.0 mg/Kg
Fluoride, Distilled	SM 4500-F B,C	≤35	75-125	80-120	NA	30 mg/Kg
Flashpoint, Closed Cup	ASTM D93	≤20	NA	NA	NA	200 (°F)
Waste Ignitability, Open Cup	ASTM D92	≤35	NA	NA	NA	212 (°F)

NA – Not Applicable
RL – Reporting Limit
MDL – Method Detection Limit

Parameter (Table 5-12) Sediments, Soils, Residuals, and Hazardous Waste	**Method Reference**	**Matrix Precision (RPD)**	**Matrix Accuracy (%R)**	**LCS Accuracy (%R)**	**MDL**	**RL**
Nitrate/Nitrite	EPA 353.1	≤35	75-125	NA	NA	5.0 mg/Kg
	SM 4500-NO_3 D	≤35	75-125	NA	<0.27 mg/Kg	5.0 mg/Kg
Nitrite	SM 4500-NO_3 E	≤35	75-125	NA	NA	5.0 mg/Kg
Paint Filter Extraction	SW 9095A	≤35	NA	NA	NA	Pass/Fail
pH (pH units)	SW 9045C	≤35	NA	NA	NA	NA
Phenols, 4AAP	EPA 420.2	≤20	75-125	80-120	0.16 mg/Kg	0.5 mg/Kg
Phosphorous, Total	EPA 365.1	≤35	75-125	NA	NA	50 mg/Kg
Phosphate, Ortho	EPA 365.1	≤20	90-110	NA	NA	50 mg/Kg
Silica	SM 4500 Si D	≤35	75-125	NA	NA	5.0 mg/Kg
Solids, Total	SM 2540 G	≤35	NA	NA	NA	0.01%
Solids, Total Volatile	EPA 160.4	≤35	NA	NA	NA	0.01%
Sulfate	SM 4500 SO_4 E	≤35	75-125	NA	NA	100 mg/Kg
Total Kjedahl Nitrogen (TKN)	EPA 351.2	≤20	90-110	90-110	NA	100 mg/Kg

NA – Not Applicable
RL – Reporting Limit
MDL – Method Detection Limit

Table 5-13
Analytical Methods and Quality Assurance Objectives for Metals in Sediments, Soils, Residual, and Hazardous Waste

Parameter: (Table 5-13: Metals in Sediments, Soils, Residual, and Hazardous Waste)	**Method Reference**	**Matrix Precision (RPD)**	**Matrix Accuracy (%R)**	**LCS Accuracy (%R)**	**MDL (mg/Kg)**	**RL (mg/Kg)**
Aluminum as Al	SW 6010 B	≤20	75-125	85-115	2.1	5.0
Antimony as Sb	SW 6010B	≤20	75-125	85-110	3.6	5.0
	SW 7041	≤20	75-125	80-120	0.96	2.0
Arsenic as As	SW 6010B	≤15	75-120	90-110	4.0	4.0
	SW 7060 A	≤20	75-125	80-120	0.33	1.0
Barium as Ba	SW 6010B	≤20	75-125	80-105	0.12	0.50
Beryllium as Be	SW 6010B	≤20	80-110	85-110	0.11	0.50
	SW 7091	≤20	75-125	80-120	0.033	0.25
Boron	SW 6010 B	≤20	75-125	80-115	5.0	5.0
Cadmium as Cd	SW 6010B	≤15	75-110	85-105	0.36	1.0
	SW 7131 A	≤20	75-125	80-120	0.054	0.50
Calcium as Ca	SW 6010B	≤20	75-125	85-115	3.0	50
Chromium as Cr	SW 6010B	≤20	75-125	85-105	0.40	1.0
	SW 7191	≤20	75-125	80-120	0.075	0.50
Chromium, Hexavalent	SW 7196A	≤20	75-125	NA	0.0020	0.020
Cobalt as Co	SW 6010B	≤20	75-125	80-110	0.72	1.0

NA – Not Applicable
RL – Reporting Limit
MDL – Method Detection Limit

Parameter: (Table 5-13: Metals in Sediments, Soils, Residual, and Hazardous Waste)	**Method Reference**	**Matrix Precision (RPD)**	**Matrix Accuracy (%R)**	**LCS Accuracy (%R)**	**MDL (mg/Kg)**	**RL (mg/Kg)**
Copper as Cu	SW 6010B	≤20	75-125	85-105	0.21	1.0
	SW 7211	≤20	75-125	80-120	0.22	1.0
Iron as Fe	SW 6010B	≤10	75-125	85-115	2.6	5.0
Lithium as Li	SW 6010B	≤20	75-125	80-120	1.1	2.5
Lead as Pb	SW 6010B	≤15	75-125	85-105	4.6	5.0
	SW 7421	≤20	75-125	80-120	0.48	1.0
Magnesium as Mg	SW 6010B	≤10	75-125	85-115	2.6	50
Manganese as Mn	SW 6010B	≤20	75-125	85-110	0.20	0.50
Mercury as Hg	SW 7471 A	≤30	35-130	70-105	0.0012	0.020
	EPA 245.5	≤30	35-130	70-105	0.0012	0.020
Molybdenum as Mo	SW 6010B	≤15	75-115	85-105	2.0	2.5
	SW 7481	≤20	75-125	80-120	0.57	2.0
Nickel as Ni	SW 6010B	≤15	75-125	85-105	1.5	2.5
	SW 7521	≤20	75-125	80-120	0.60	2.0
Potassium as K	SW 6010B	≤20	75-125	85-115	5.7	50
Selenium as Se	SW 6010B	≤20	75-115	85-105	7.5	7.5
	SW 7740	≤20	75-125	80-120	0.66	1.0
Silver as Ag	SW 6010B	≤20	75-125	85-105	0.52	1.0
	SW 7761 A	≤20	75-125	80-120	0.018	0.25
Sodium as Na	SW 6010B	≤10	75-125	80-120	7.0	50
Strontium as Sr	SW 6010B	≤20	75-125	90-110	1.4	5.0
Thallium as Tl	SW 6010B	≤10	75-110	85-110	7.4	50
	SW 7841	≤20	75-125	80-120	0.18	1.0
Tin as Sn	SW 6010B	≤20	75-125	90-110	5.0	5.0
Titanium as Ti	SW 6010B	≤20	75-125	90-110	0.48	2.5
Vanadium as V	SW 6010B	≤20	75-125	85-110	1.2	2.5
Zinc as Zn	SW 6010B	≤20	75-125	85-105	0.44	1.0

RL – Reporting Limit
MDL – Method Detection Limit
NOTE: Method detection limit based upon 3 times the water detection limit

Table 5-14
Analytical Methods and Quality Assurance Objectives
Extractable Organics Sediments, Soils, Residuals Soils, and Hazardous Waste

Parameter (Table 5-14: Extractable Organic Sediments, Soils, Residuals Soil, and Residual Hazardous Waste)	Method Reference	Matrix Precision (RPD)	Matrix Accuracy (%R)	LCS Accuracy (%R)	MDL (mg/Kg)	RL (mg/Kg)
Semi- Volatiles by GC/MS						
Acenaphthene	SW 8270 C	≤20	35-125	55-110	0.081	0.33
Acenaphthylene	SW 8270 C	≤20	40-125	55-110	0.075	0.33
Anthracene	SW 8270 C	≤25	35-130	55-120	0.078	0.33
Benzidine	SW 8270 C	≤50	10-105	10-105	0.032	3.3
Benzoic Acid	SW 8270 C	≤50	52-142	10-96	0.037	0.66
Benzo(a)anthracene	SW 8270 C	≤35	40-135	55-125	0.084	0.33
Benzo(b)fluoranthene	SW 8270 C	≤30	40-135	55-135	0.082	0.33
Benzo(k)fluoranthene	SW 8270 C	≤30	40-135	50-135	0.084	0.33
Benzo(ghi)perylene	SW 8270 C	≤30	35-130	50-135	0.075	0.33
Benzo(a)pyrene	SW 8270 C	≤35	40-135	55-130	0.074	0.33
Benzyl alcohol	SW 8270 C	≤30	35-130	45-115	0.065	0.33
Butyl benzyl phthalate	SW 8270 C	≤25	45-140	50-145	0.084	0.33
Bis(2-Chloroethoxy)methane	SW 8270 C	≤25	30-120	35-120	0.082	0.33
Bis(2-Chloroethyl)ether	SW 8270 C	≤30	30-120	35-115	0.083	0.33
Bis(2-chloroisopropyl)ether	SW 8270 C	≤25	30-120	30-115	0.080	0.33
Bis(2-ethylhexyl)phthalate	SW 8270 C	≤40	45-140	50-145	0.032	0.33
4-Bromophenylphenyl ether	SW 8270 C	≤25	40-135	50-135	0.087	0.33
Carbazole	SW 8270 C	≤20	45-140	55-135	0.081	0.33
4-Chloroaniline	SW 8270 C	≤20	30-125	35-120	0.104	0.33
4-Chloro-3-methylphenol	SW 8270 C	≤25	40-130	55-115	0.069	0.33
2-Chloronaphthalene	SW 8270 C	≤20	35-125	45-120	0.088	0.33
2-Chlorophenol	SW 8270 C	≤30	30-115	35-100	0.067	0.33
4-Chlorophenylphenyl ether	SW 8270 C	≤20	40-135	50-130	0.094	0.33
Chrysene	SW 8270 C	≤35	40-135	55-125	0.083	0.33
Dibenzo(a,h)anthracene	SW 8270 C	≤30	40-135	55-135	0.059	0.33
Dibenzofuran	SW 8270 C	≤20	40-135	55-130	0.082	0.33
1,2-Dichlorobenzene	SW 8270 C	≤30	25-120	25-115	0.076	0.33
1,3-Dichlorobenzene	SW 8270 C	≤35	25-115	25-110	0.083	0.33
1,4-Dichlorobenzene	SW 8270 C	≤30	25-115	25-110	0.086	0.33
3,3'-Dichlorobenzidine	SW 8270 C	≤30	30-125	40-135	0.077	0.33
2,4-Dichlorophenol	SW 8270 C	≤40	30-125	45-105	0.078	0.33
Diethyl phthalate	SW 8270 C	≤30	45-140	55-140	0.089	0.33
2,4-Dimethylphenol	SW 8270 C	≤20	35-110	45-100	0.070	0.33

RL – Reporting Limit
MDL – Method Detection Limit

Parameter (Table 5-14: Extractable Organic Sediments, Soils, Residuals Soil, and Residual Hazardous Waste)	**Method Reference**	**Matrix Precision (RPD)**	**Matrix Accuracy (%R)**	**LCS Accuracy (%R)**	**MDL (mg/Kg)**	**RL (mg/Kg)**
Dimethyl phthalate	SW 8270 C	≤40	40-135	50-140	0.081	0.33
Di-n-butyl phthalate	SW 8270 C	≤25	40-135	50-145	0.088	0.33
Di-n-octyl phthalate	SW 8270 C	≤25	50-145	60-150	0.085	0.33
2,4-Dinitrophenol	SW 8270 C	≤50	10-60	10-75	0.034	0.33
2,5-Dinitrophenol	SW 8270 C	≤45	10-100	10-105	0.057	0.33
2,4-Dinitrotoluene	SW 8270 C	≤30	40-135	50-145	0.059	0.33
2,6-Dinitrotoluene	SW 8270 C	≤30	30-125	60-140	0.061	0.33
1,2-Diphenylhydrazine	SW 8270 C	≤20	40-135	50-125	0.054	0.33
Fluoranthene	SW 8270 C	≤45	40-135	55-130	0.076	0.33
Fluorene	SW 8270 C	≤20	40-130	55-115	0.082	0.33
Hexachlorobenzene	SW 8270 C	≤25	40-135	55-135	0.082	0.33
Hexachlorobutadiene	SW 8270 C	≤30	30-115	30-110	0.085	0.33
Hexachlorocyclopentadiene	SW 8270 C	≤50	10-105	20-115	0.059	0.66
Hexachloroethane	SW 8270 C	≤30	25-120	25-115	0.082	0.33
Indeno(1,2,3-cd)pyrene	SW 8270 C	≤45	40-135	55-135	0.074	0.33
Isophorone	SW 8270 C	≤30	35-130	50-120	0.082	0.33
2-Methyl-4,6-dinitrophenol	SW 8270 C	≤45	10-90	10-90	0.036	0.33
2-Methylnaphthalene	SW 8270 C	≤25	35-120	45-115	0.081	0.33
2-Methylphenol (o-cresol)	SW 8270 C	≤20	35-120	45-100	0.072	0.33
4-Methylphenol (p-cresol)	SW 8270 C	≤25	35-120	45-100	0.065	0.33
Naphthalene	SW 8270 C	≤30	35-115	40-100	0.077	0.33
2-Nitroaniline	SW 8270 C	≤25	45-140	55-140	0.070	0.33
3-Nitroaniline	SW 8270 C	≤50	45-140	55-140	0.064	0.33
4-Nitroaniline	SW 8270 C	≤40	45-140	50-145	0.056	0.33
Nitrobenzene	SW 8270 C	≤25	35-120	40-110	0.096	0.33
2-Nitrophenol	SW 8270 C	≤30	25-120	40-105	0.076	0.33
4-Nitrophenol	SW 8270 C	≤50	20-115	40-135	0.056	0.33
N-Nitrosodi-n-butylamine	SW 8270 C	≤25	35-130	45-130	0.078	0.33
N-Nitrosodiethylamine	SW 8270 C	≤35	30-125	30-115	0.074	0.33
N-Nitrosodimethylamine	SW 8270 C	≤40	25-120	30-110	0.131	0.33
N-Nitrosodi-n-propylamine	SW 8270 C	≤30	25-110	40-115	0.068	0.33
N-Nitrosodiphenylamine	SW 8270 C	≤25	40-135	50-135	0.074	0.33
N-Nitrosopyrrolidine	SW 8270 C	≤50	35-130	45-125	0.070	0.33
Pentachlorophenol	SW 8270 C	≤40	15-110	15-110	0.077	0.33
Pentachlorobenzene	SW 8270 C	≤25	35-130	50-125	0.080	0.33
Phenanthrene	SW 8270 C	≤35	40-135	55-125	0.081	0.33
Phenol	SW 8270 C	≤30	30-120	40-100	0.041	0.33
Pyrene	SW 8270 C	≤40	35-130	55-130	0.090	0.33
Pyridine	SW 8270 C	≤50	20-115	15-90	0.038	0.33

RL – Reporting Limit
MDL – Method Detection Limit

Parameter (Table 5-14: Extractable Organic Sediments, Soils, Residuals Soil, and Residual Hazardous Waste)	Method Reference	Matrix Precision (RPD)	Matrix Accuracy (%R)	LCS Accuracy (%R)	MDL (mg/Kg)	RL (mg/Kg)
1,2,4,5-Tetrachlorobenzene	SW 8270 C	≤25	35-125	45-115	0.083	0.33
2,3,4,6-Tetrachlorophenol	SW 8270 C	≤20	70-130	70-130	NA	0.33
1,2,4-Trichlorobenzene	SW 8270 C	≤25	30-120	40-110	0.091	0.33
2,4,5-Trichlorophenol	SW 8270 C	≤50	30-125	45-125	0.080	0.33
2,4,6-Trichlorophenol	SW 8270 C	≤50	25-120	35-125	0.070	0.33
Surrogates						
2,4,6-Tribromophenol	SW 8270 C	NA	NA	40-135	NA	NA
2-Fluorobiphenyl	SW 8270 C	NA	NA	55-105	NA	NA
p-Terphenyl-d14	SW 8270 C	NA	NA	55-125	NA	NA
Nitrobenzene-d5	SW 8270 C	NA	NA	45-100	NA	NA
2-Fluorophenol	SW 8270 C	NA	NA	15-110	NA	NA
Phenol-d6	SW 8270 C	NA	NA	25-120	NA	NA
PAH – Polynuclear Aromatic Hydrocarbons by 8270 SIMS						
Acenaphthene	SW 8270 C SIM	≤35	37-127	44-110	0.00193	0.0033
Acenaphthylene	SW 8270 C SIM	≤35	7-97	41-111	0.00245	0.0033
Anthracene	SW 8270 C SIM	≤35	18-99	46-111	0.00180	0.0033
Benzo(a)anthracene	SW 8270 C SIM	≤35	13-103	64-116	0.00329	0.0033
Benzo(b)fluoranthene	SW 8270 C SIM	≤35	15-105	69-112	0.00165	0.0033
Benzo(k)fluoranthene	SW 8270 C SIM	≤35	20-110	64-117	0.00153	0.0033
Benzo(ghi)perylene	SW 8270 C SIM	≤35	16-106	51-120	0.00207	0.0033
Benzo(a)pyrene	SW 8270 C SIM	≤35	9-99	55-111	0.00202	0.0033
Chrysene	SW 8270 C SIM	≤35	18-108	76-106	0.00163	0.0033
Dibenzo(a,h)anthracene	SW 8270 C SIM	≤35	2-92	49-120	0.00098	0.0033
Fluoranthene	SW 8270 C SIM	≤35	22-112	71-110	0.00219	0.0033
Fluorene	SW 8270 C SIM	≤35	16-106	52-107	0.00119	0.0033
Indeno(1,2,3-cd)pyrene	SW 8270 C SIM	≤35	3-93	38-125	0.00168	0.0033
1-Methylnaphthalene	SW 8270 C SIM	≤35	70-130[1]	70-130[1]	0.00089	0.0033
2-Methylnaphthalene	SW 8270 C SIM	≤35	70-130[1]	70-130[1]	0.00077	0.0033
Naphthalene	SW 8270 C SIM	≤35	10-100	39-112	0.00082	0.0033
Phenanthrene	SW 8270 C SIM	≤35	27-117	58-112	0.00190	0.0033
Pyrene	SW 8270 C SIM	≤35	26-116	78-107	0.00310	0.0033
Surrogates						
2-Fluorobiphenyl	SW 8270 C SIM	NA	38-105	33-115	NA	NA
Nitrobenzene-d5	SW 8270 C SIM	NA	37-108	21-111	NA	NA
p-Terphenyl-d14	SW 8270 C SIM	NA	35-111	55-119	NA	NA

[1] Default limits used until lab generated limits can be determined
RL – Reporting Limit
MDL – Method Detection Limit

Parameter (Table 5-14: Extractable Organic Sediments, Soils, Residuals Soil, and Residual Hazardous Waste)	Method Reference	Matrix Precision (RPD)	Matrix Accuracy (%R)	LCS Accuracy (%R)	MDL[2] (mg/Kg)	RL[2] (mg/Kg)
PAH – Polynuclear Aromatic Hydrocarbons by HPLC						
Acenaphthene	SW 8310	≤35	33-123	30-120	18	42
Acenaphthylene	SW 8310	≤35	31-121	30-120	5.3	42
Anthracene	SW 8310	≤35	29-119	26-116	2.7	17
Benzo(a)anthracene	SW 8310	≤35	31-121	30-120	1.6	17
Benzo(b)fluoranthene	SW 8310	≤35	32-122	35-125	3.3	17
Benzo(k)fluoranthene	SW 8310	≤35	42-132	36-126	2.0	17
Benzo(ghi)perylene	SW 8310	≤35	32-122	32-122	1.7	17
Benzo(a)pyrene	SW 8310	≤35	43-133	34-124	3.6	17
Chrysene	SW 8310	≤35	44-134	34-124	1.7	17
Dibenzo(a,h)anthracene	SW 8310	≤35	35-125	33-123	3.9	17
Fluoranthene	SW 8310	≤35	39-129	33-123	2.9	17
Fluorene	SW 8310	≤35	34-124	34-124	4.9	35
Indeno(1,2,3-cd)pyrene	SW 8310	≤35	37-127	36-126	1.6	17
1-Methylnaphthalene	SW 8310	≤20	70-130	30-120	3.9	42
2-Methylnaphthalene	SW 8310	≤20	70-130	30-120	3.2	42
Naphthalene	SW 8310	≤35	27-117	31-121	3.7	17
Phenanthrene	SW 8310	≤35	54-144	35-125	5.2	17
Pyrene	SW 8310	≤35	42-132	32-122	4.2	42
2-Fluorobiphenyl (Surr)	SW 8310	NA	30-120	30-120	NA	NA

[1] Default limits used until lab generated limits can be determined
[2] Units for 8310 are in µg/Kg
RL – Reporting Limit
MDL – Method Detection Limit

Table 5-15
Analytical Methods and Quality Assurance Objectives for Extractable Hydrocarbons and PCBs in Sediments, Soils, Residuals, and Hazardous Waste

Parameter (Table 5-15: Extractable hydrocarbons and PCBs in Sediments, Soils, Residuals, and Hazardous Waste)	Method Reference	Matrix Precision (RPD)	Matrix Accuracy (%R)	LCS Accuracy (%R)	MDL (mg/Kg)	RL (mg/Kg)
PCB – Polychlorinated Biphenyls in Soils						
PCB-1016	SW 8082 soil	≤35	36-126	41-131	0.003	0.5
PCB-1221	SW 8082 Soil	≤35	36-126	41-131	0.016	0.5
PCB-1232	SW 8082 Soil	≤35	36-126	41-131	0.020	0.5
PCB-1242	SW 8082 Soil	≤35	36-126	41-131	0.013	0.5
PCB-1248	SW 8082 Soil	≤35	36-126	41-131	0.003	0.5
PCB-1254	SW 8082 Soil	≤35	36-126	41-131	0.025	0.5

RL – Reporting Limit
MDL – Method Detection Limit

Parameter (Table 5-15: Extractable hydrocarbons and PCBs in Sediments, Soils, Residuals, and Hazardous Waste)	**Method Reference**	**Matrix Precision (RPD)**	**Matrix Accuracy (%R)**	**LCS Accuracy (%R)**	**MDL (mg/Kg)**	**RL (mg/Kg)**
PCB-1260	SW 8082 Soil	≤35	36-126	41-131	0.003	0.5
PCB-1268	SW 8082 Soil	≤35	36-126	41-131	0.063	0.5
Surrogates						
Tetrachlorometaxylene (TCMX)	SW 8082 Soil	NA	NA	46 – 136	NA	NA
Decachlorobiphenly (DCB)	SW 8082 Soil	NA	NA	59 – 140	NA	NA
Extractable Hydrocarbons						
Diesel	OA-2	≤50	45 – 140	55 – 150	3.3	10
Gasoline	OA-2	≤50	25 – 120	40 – 135	3.3	10
Motor Oil	OA-2	≤50	55 – 150	50 – 145	3.4	10
Surrogate						
N-Octacosane	OA-2	NA	NA	50 – 145	1.0	1.0

RL – Reporting Limit
MDL – Method Detection Limit

Table 5-16
Analytical Methods and Quality Assurance Objectives For PCB's in Oils and Wipes

Parameter (Table 5-16: Extractable PCBs in Wipes and Oils)	**Method Reference**	**Matrix Precision (RPD)**	**Matrix Accuracy (%R)**	**LCS Accuracy (%R)**	**RL (mg/Kg)**
PCB-1016	SW 8082 Wipe	≤35	43-133	43-133	10
	SW 8082 Oil	≤20	29-119	25-113	2.0
PCB-1221	SW 8082 Wipe	≤35	43-133	43-133	10
	SW 8082 Oil	≤20	29-119	25-113	2.0
PCB-1232	SW 8082 Wipe	≤35	43-133	43-133	10
	SW 8082 Oil	≤20	40-130	29-119	2.0
PCB-1242	SW 8082 Wipe	≤35	43-133	43-133	10
	SW 8082 Oil	≤20	46-136	47-92	2.0
PCB-1248	SW 8082 Wipe	≤35	43-133	43-133	10
	SW 8082 Oil	≤20	40-130	29-119	2.0
PCB-1254	SW 8082 Wipe	≤35	43-133	43-133	10
	SW 8082 Oil	≤20	47-137	38-128	2.0
PCB-1260	SW 8082 Wipe	≤35	43-133	43-133	10
	SW 8082 Oil	≤20	29-119	29-96	2.0
PCB-1268	SW 8082 Wipe	≤35	43-133	43-133	10
	SW 8082 Oil	≤20	29-119	29-96	2.0
Tetrachlorometaxylene (TCMX)	SW 8082 Wipe	NA	NA	42-132	NA
	SW 8082 Oil	NA	NA	15-105	NA
Decachlorobiphenly (DCB)	SW 8082 Wipe	NA	NA	56-146	NA
	SW 8082 Oil	NA	NA	10-100	NA

RL – Reporting Limit

Table 5-17
Analytical Methods and Quality Assurance Objectives
For Purgeable Volatile Organics in Sediments, Soils, and Hazardous Waste

Parameter (Table 5-17: Purgeable Volatile Organics in Sediments, Soils, and Hazardous Waste)	Method Reference	Matrix Precision (RPD)	Matrix Accuracy (%R)	LCS Accuracy (%R)	MDL (µg/Kg)	RL (µg/Kg)
Volatiles by GC/MS						
Acetone	SW 8260 B	≤50	45-140	65-150	0.81	50
Acrolein	SW 8260 B	≤20	70-130[1]	70-130[1]	5.6	100
Acrylonitrile	SW 8260 B	≤50	35-130	60-150	0.36	50
Benzene	SW 8260 B, OA-1	≤40	45-140	75-135	0.20	5.0
Bromobenzene	SW 8260 B	≤25	40-135	65-145	0.23	5.0
Bromochloromethane	SW 8260 B	≤30	45-140	70-140	0.33	5.0
Bromodichloromethane	SW 8260 B	≤25	40-135	70-135	0.24	5.0
Bromoform	SW 8260 B	≤20	30-125	65-140	0.29	10
Bromomethane	SW 8260 B	≤45	35-130	35-130	0.70	20
2-Butanone(MEK)	SW 8260 B	≤50	40-135	70-150	1.4	50
Carbon disulfide	SW 8260 B	≤35	30-125	55-130	0.44	5.0
Carbon tetrachloride	SW 8260 B	≤30	45-140	60-145	0.81	5.0
Chlorobenzene	SW 8260 B	≤20	40-135	65-140	0.17	5.0
Chloroethane	SW 8260 B	≤30	35-130	50-145	0.65	20
2-Chloroethyl vinyl ether	SW 8260 B	≤50	10-105	35-130	2.0	50
2-Chlorotoluene	SW 8260 B	≤30	40-135	55-150	0.23	5.0
Chloroform	SW 8260 B	≤40	45-140	70-135	0.15	5.0
Chloromethane	SW 8260 B	≤30	35-130	45-140	1.1	20
4-Chlorotoluene	SW 8260 B	≤50	40-135	60-145	0.14	5.0
Cyclohexane	SW 8260 B	≤50	35-130	45-140	0.14	100
1,1-Dichloroethane	SW 8260 B	≤35	35-130	65-135	0.18	5.0
1,1-Dichloroethene	SW 8260 B	≤35	40-135	60-140	0.29	5.0
1,1-Dichloropropene	SW 8260 B	≤35	40-135	70-135	0.57	5.0
Dibromochloromethane	SW 8260 B	≤25	40-135	70-135	0.16	5.0
1,2-cis-Dichloroethene	SW 8260 B	≤35	40-135	65-135	0.26	5.0
1,2-Dibromo-3 chloropropane	SW 8260 B	≤40	40-135	40-135	0.47	50
1,2-Dibromoethane(EDB)	SW 8260 B	≤25	40-130	65-130	0.21	50

RL – Reporting Limit
MDL – Method Detection Limit

Parameter (Table 5-17: Purgeable Volatile Organics in Sediments, Soils, and Hazardous Waste)	Method Reference	Matrix Precision (RPD)	Matrix Accuracy (%R)	LCS Accuracy (%R)	MDL (µg/Kg)	RL (µg/Kg)
1,2-Dichlorobenzene	SW 8260 B	≤25	35-130	65-140	0.21	5.0
1,2-Dichloroethane	SW 8260 B	≤50	45-140	70-150	0.20	5.0
1,2-Dichloropropane	SW 8260 B	≤25	40-135	55-150	0.28	5.0
1,2-trans-Dichloroethene	SW 8260 B	≤40	40-135	65-135	0.29	5.0
Dibromomethane	SW 8260 B	≤25	45-140	75-140	0.15	5.0
Dichlorodifluoromethane	SW 8260 B	≤35	30-125	30-125	0.26	15
1,3-cis-Dichloropropene	SW 8260 B	≤30	35-130	70-125	0.19	5.0
1,3-Dichlorobenzene	SW 8260 B	≤20	35-130	60-145	0.20	5.0
1,3-Dichloropropane	SW 8260 B	≤25	45-135	75-140	0.31	5.0
1,3-trans-Dichloropropene	SW 8260 B	≤25	35-130	65-125	0.17	5.0
1,4-Dichlorobenzene	SW 8260 B	≤25	35-130	55-145	0.19	5.0
2,2-Dichloropropane	SW 8260 B	≤35	40-135	65-140	0.51	20
Di-isopropyl ether	SW 8260 B	≤30	40-135	70-135	0.45	5.0
Ethanol	SW 8260 B	≤50	35-130	45-140	14	500
Ethylbenzene	SW 8260 B, OA-1	≤50	45-140	65-145	0.19	5.0
Heptane	SW 8260 B	≤50	30-125	55-150	0.65	10
2-Hexanone	SW 8260 B	≤50	25-120	50-145	0.55	50
Hexachlorobutadiene	SW 8260 B	≤30	35-130	55-150	0.66	25
Hexane	SW 8260 B	≤40	30-125	50-145	0.92	25
Iodomethane	SW 8260 B	≤45	25-120	35-130	0.68	5.0
4-Isopropyltoluene	SW 8260 B	≤50	40-135	65-140	0.21	5.0
Isopropylbenzene	SW 8260 B	≤30	40-135	65-140	0.20	5.0
m&p-Xylene	SW 8260 B, OA-1	≤50	45-140	65-145	0.77	5.0
4-Methyl-2-pentanone (MIBK)	SW 8260 B	≤50	35-130	55-150	0.56	50
Methyl acetate	SW 8260 B	≤50	30-125	50-145	1.3	5.0
Methylene chloride	SW 8260 B	≤50	35-130	65-150	0.64	50
Methyl-t-butyl ether (MTBE)	SW 8260 B, OA-1	≤40	50-145	75-145	0.12	5.0
Naphthalene	SW 8260 B	≤50	20-115	55-150	0.40	25
n-Butyl benzene	SW 8260 B	≤50	30-125	50-145	0.28	5.0
n-Propylbenzene	SW 8260 B	≤50	40-135	60-140	0.13	5.0

RL – Reporting Limit
MDL – Method Detection Limit

Parameter (Table 5-17: Purgeable Volatile Organics in Sediments, Soils, and Hazardous Waste)	**Method Reference**	**Matrix Precision (RPD)**	**Matrix Accuracy (%R)**	**LCS Accuracy (%R)**	**MDL (µg/Kg)**	**RL (µg/Kg)**
o-Xylenes	SW 8260 B	≤50	45-140	65-145	0.31	5.0
sec-Butyl benzene	SW 8260 B	≤25	35-130	60-135	0.23	5.0
Styrene	SW 8260 B	≤20	40-135	65-140	0.18	5.0
t-Amylmethyl ether	SW 8260 B	≤40	40-135	50-145	0.18	5.0
t-Butanol	SW 8260 B	≤35	45-140	30-125	1.1	5.0
t-Butylethyl ether	SW 8260 B	≤40	40-135	50-145	0.17	5.0
tert-Butyl benzene	SW 8260 B	≤40	35-130	60-140	0.14	5.0
Tetrachloroethene	SW 8260 B	≤50	40-135	65-140	0.23	5.0
Tetrahydrofuran	SW 8260 B	≤50	55-145	65-150	1.2	250
1,1,1,2-Tetrachloroethane	SW 8260 B	≤25	40-135	65-135	0.16	5.0
1,1,1-Trichloroethane	SW 8260 B	≤25	45-140	65-140	0.27	5.0
1,1,2,2-Tetrachloroethane	SW 8260 B	≤40	35-130	60-135	0.21	5.0
1,1,2-Trichloroethane	SW 8260 B	≤25	45-140	75-135	0.33	5.0
1,1,2-Trichlorofluoroethane	SW 8260 B	≤40	40-135	70-135	0.24	10
Toluene	SW 8260 B, OA-1	≤40	40-135	60-145	0.16	5.0
1,3,5-Trimethylbenzene	SW 8260 B	≤30	45-140	60-150	0.33	5.0
trans-1,4-Dichloro-2-butene	SW 8260 B	≤40	35-130	60-130	0.32	<10
Trichloroethene	SW 8260 B	≤25	45-135	80-130	0.24	5.0
Trichlorofluoromethane	SW 8260 B	≤35	40-135	50-140	0.24	20
1,2,3-Trichlorobenzene	SW 8260 B	≤50	25-120	50-145	0.31	25
1,2,3-Trichloropropane	SW 8260 B	≤30	35-130	65-140	0.19	5.0
1,2,4-Trichlorobenzene	SW 8260 B	≤30	25-120	50-145	0.50	25
1,2,4-Trimethylbenzene	SW 8260 B	≤35	40-135	55-150	0.24	5.0
Total Xylenes	SW 8260 B, OA-1	≤50	45-140	65-145	0.77	15
Vinyl acetate	SW 8260 B	≤50	10-100	50-145	1.3	<10
Vinyl chloride	SW 8260 B	≤35	35-130	45-135	0.42	15

Surrogates

Dibromofluoromethane	SW 8260 B	NA	NA	75-115	NA	NA
4-Bromofluorobenzene	SW 8260 B	NA	NA	70-130	NA	NA
Toluene-d8	SW 8260 B	NA	NA	75-115	NA	NA

RL – Reporting Limit
MDL – Method Detection Limit
NA – Not Applicable

Parameter (Table 5-17: Purgeable Volatile Organics in Sediments, Soils, and Hazardous Waste)	Method Reference	Matrix Precision (RPD)	Matrix Accuracy (%R)	LCS Accuracy (%R)	MDL (mg/Kg)	RL (mg/Kg)
BTEX by GC (FID)						
Benzene	SW 8015 B, OA-1	≤25	65-150	55-130	0.197	0.25
Ethyl Benzene	SW 8015 B, OA-1	≤35	65-150	60-125	0.224	0.5
Methyl-tert-butyl ether (MTBE)	SW 8015 B, OA-1	≤20	70-130[1]	55-150	0.263	2.0
Total Purgeable Hydrocarbons (TPH)	SW 8015 B, OA-1	≤20	70-130[1]	50-140	6.58	10
1,2,4-Trimethylbenzene	SW 8015 B, OA-1	≤20	70-130[1]	70-130[1]	NA	0.5
1,3,5-Trimethylbenzene	SW 8015 B, OA-1	≤20	70-130[1]	70-130[1]	NA	0.5
Toluene	SW 8015 B, OA-1	≤30	65-150	60-120	0.212	0.5
m&p-Xylene	SW 8015 B, OA-1	≤20	65-150	65-125	0.216	0.5
o-Xylene	SW 8015 B, OA-1	≤20	65-150	65-125	0.216	0.5
Total Xylene	SW 8015 B, OA-1	≤20	65-150	65-125	0.216	0.5
Surrogate						
4-Bromofluorobenzene	SW 8015 B, OA-1	NA	NA	70-125	NA	NA
BTEX by GC (PID)						
Benzene	SW 8021 B	≤25	65-150	55-130	0.049	0.20
Ethyl Benzene	SW 8021 B	≤35	65-150	60-125	0.050	0.5
Methyl-tert-butyl ether (MTBE)	SW 8021 B	≤20	70-130[1]	55-150	0.042	0.5
1,2,4-Trimethylbenzene	SW 8021 B	≤20	70-130[1]	70-130[1]	NA	5.0
1,3,5-Trimethylbenzene	SW 8021 B	≤20	70-130[1]	70-130[1]	NA	5.0
Toluene	SW 8021 B	≤30	65-150	60-120	0.049	0.5
Surrogate						
4-Bromofluorobenzene	SW 8021 B	NA	NA	70-125	NA	NA

RL – Reporting Limit
MDL – Method Detection Limit
NA – Not Applicable
[1] Default Limits used until lab generated limits can be determined

Table 5-18
Analytical Methods and Quality Assurance Objectives For Direct Aqueous Injection Analysis

Parameter (Table 5-18: Direct Aqueous Injection Analysis)	**Method Reference**	**Matrix Precision (RPD)**	**Matrix Accuracy (%R)**	**LCS Accuracy (%R)**	**RL (µg/Kg)**
n-Butanol	SW 8015 B	≤20	75-125	80-120	10
2-Butoxyethanol	SW 8015 B	≤20	75-125	80-120	10
Ethanol	SW 8015 B	≤20	75-125	80-120	10
Ethylacetate	SW 8015 B	≤20	75-125	80-120	20
Ethylene glycol	SW 8015 B	≤20	75-125	80-120	10
Isopropanol	SW 8015 B	≤20	75-125	80-120	10
Methanol	SW 8015 B	≤20	75-125	80-120	10
Propylene Glycol	SW 8015 B	≤20	75-125	80-120	10

RL – Reporting Limit

Section 6.0
Sampling Procedures

TestAmerica Analytical Testing Corp – Cedar Falls, IA provides sampling services. Laboratory personnel do not collect most of the samples received by the laboratory. In these cases, the laboratory's responsibility in the sample collection process lies in supplying the sampler with the proper containers and preservatives.

6.1 Sampling Containers

TestAmerica Analytical Testing Corp – Cedar Falls, IA offers pre-cleaned sampling containers for use by clients and laboratory field sampling personnel. These containers are obtained from reputable container manufacturers and are cleaned to EPA specifications (Specifications and Guidance for Contaminant-Free Sample Containers OSWER Directive #9240.0-05A Dec 92).

6.1.1 Preservatives

The grades of the preservatives are at a minimum:

6.1.1.1 Hydrochloric Acid – Reagent ACS (Certified VOA Free) or equivalent
6.1.1.2 Methanol – Purge and Trap grade
6.1.1.3 Nitric Acid – Instra-Analyzed or equivalent
6.1.1.4 Sodium Bisulfate – ACS Grade or equivalent
6.1.1.5 Sodium Hydroxide – Instra-Analyzed or equivalent
6.1.1.6 Sulfuric Acid – Instra-Analyzed or equivalent
6.1.1.7 Sodium Thiosulfate – ACS Grade or equivalent

6.1.2 Preparing Bottle Orders

Sample containers are preserved according to sampling and analytical method requirements. They are then sent to clients for use in collecting samples or are used by field sampling personnel. Information for client bottle requests are summarized on a Bottle Request Form (Figure 6-1). The shipping date, type, number of containers, Chain of Custody (COC), method of shipment and project name/number are maintained by the lab. Shipping personnel ensure that bottle stock is rotated so that first in is first out. Completed forms are filed in the log-in area. If containers are provided direct to the client from the manufacturer or from other sources, TestAmerica Analytical Testing Corp – Cedar Falls, IA will not be responsible for any of the above records.

6.1.3 Shipping Container

Refer to TestAmerica Analytical Testing Corp – Cedar Falls Shipping SOP (CF07-12) for information regarding shipping container specifications. The contents of the shipping container are:

6.1.3.1 Chain of Custody
6.1.3.2 Temperature Surrogate
6.1.3.3 Ice bags
6.1.3.4 Return Label
6.1.3.5 Sampling Instructions (Figure 6-2)
6.1.3.6 Cushioning material
6.1.3.7 Sample Containers

6.2 Field QC Samples

The common field quality control samples are defined in the following paragraphs. The frequency of field quality control samples should be specified in the Quality Assurance Project Plan (QAPP) or by the client. TestAmerica Analytical Testing Corp – Cedar Falls, IA provides trip blanks for VOC analysis with the sample containers when requested. All blanks generated in the field will be analyzed in the analytical sequence along with the field samples.

6.2.1 Parameter Class

The parameter class is defined, for the purpose of determining the number of blank samples to be generated during the sampling episode, as a group of analytes for which the sample container type, container cleaning protocol, and preservation technique are identical. An example is total metals and hardness in water, which could be combined into a single sampling container.

6.2.2 Equipment Blank / Rinseate Blank

The equipment blank, sometimes referred to as a rinseate blank, is a sample of the water used to decontaminate sampling equipment. The source water should be as free of target analytes as possible. An aliquot of this water is poured over or through the sample collection device after decontamination, collected in a sample container, preserved with appropriate reagents, and returned to the laboratory. This serves as a check on sampling device cleanliness, and will also be affected by the site and sample handling conditions evaluated by the other types of blanks.

6.2.3 Field Blank

The field blank is water that is as free of target analytes as possible and from the same source as the equipment blank. The water is poured into a sampling container at the sampling site, preserved with the appropriate reagents, and returned to the laboratory. This serves as a check on reagent and environmental contamination.

6.2.4 Trip Blank

The trip blank pertains to volatile analysis only. This serves as a check on sample contamination originating from sample transport, sample container contamination, shipping and storage, or from certain site conditions. Trip blanks are often referred to as travel blanks. They are prepared using pre-cleaned sample containers. They are filled with organic-free water (the source of the organic free water is the same source of water used to prepare volatile standards, method blanks, LCS and sample dilutions), sealed and taken into the field with the empty containers which will be used for sampling. The recommended frequency is one trip blank per cooler (in duplicate or triplicate), per volatiles method.

6.2.5 Field Duplicates

Field duplicates are replicate samples collected from the same sampling point or location during a field collection event. This control sample is used to demonstrate the ability of both the sampling and analytical process to generate data of acceptable precision.

6.3 Field Sampling Procedures

The following procedures are followed when TestAmerica Analytical Testing Corp – Cedar Falls personnel perform field sampling. Sampling and ambient data collections are performed in accordance with currently accepted guidelines outlined by EPA. ASTM Standards on Environmental Sampling, Standard Methods for the Examination of Water and Wastewater, Test Method for Evaluating Solid Waste, SW-846 volume II: Field Manual and other EPA documents are sources of approved sampling procedures for field sampling. These references are available for use by field personnel.

A list of TestAmerica Analytical Testing Corp – Cedar Falls sampling capabilities is presented in Table 6-1. A number of different sampling protocols may need to be employed to satisfy specific project sampling requirements. The primary objective of any sampling program is to obtain a representative sample.

A thorough review of the sampling program and data collection objectives will be undertaken by the Field Services Project Manager prior to establishing sampling locations and parameters to be analyzed. A sampling and analysis plan should be prepared to establish the best procedures to obtain representative data. This plan is used to identify each sampling point, determine the type of sample required, establish the analytical parameters, and determine the type of field equipment, sample containers and preservation techniques that will be necessary to complete the program. However, not all-sampling projects warrant a sampling plan. If a client prefers not to establish a formal sampling plan due to the dynamic nature of their sampling requirements, it will be the responsibility of the sampling project coordinator to determine the best procedures to obtain representative data. Procedures used to collect samples in these cases will be in accordance with this Quality Assurance Manual.

The cleaning procedures outlined in this section are to be used by all laboratory and field personnel to clean sampling and other field equipment prior to sample collection. Whenever possible, a sufficient quantity of clean equipment will be transported to the sampling site to insure that the entire sampling event may be conducted without the need for cleaning (decontamination) in the field. Whenever field equipment cleaning is required, the procedures are recorded on the Field Services Form (Figure 6-3).

Field equipment and instrumentation used by TestAmerica Analytical Testing Corp – Cedar Falls is listed in each section of sampling protocols (Tables 6-2 – 6-7). Routinely used field measurement instrumentation is listed in Section 9 (Calibration), Table 9-1. Miscellaneous equipment used in all types of sampling events is listed in Table 6-8.

Disposable gloves are worn while sampling at all sampling sites. New, unused gloves are worn for each separate sampling point.

The following cleaning and decontamination equipment and reagents may be present at the sampling site when field cleaning is anticipated: tap water; analyte-free water; Liquinox or an equivalent laboratory-grade detergent; cleaning brushes; wash tubs and waste receptacles. Tap water and deionized water are transported to the sampling site in pre-cleaned polyethylene containers. The laboratory-grade detergent is transported to the field in original containers.

Analyte free water is defined as being free of interferences and analytes of interest (below laboratory reporting limits). TestAmerica Analytical Testing Corp - Cedar Falls utilizes a commercial water treatment system, which employs reverse osmosis that produces laboratory water. For volatile organic free water, deionized water is passed through a filter tested and certified to ANSI/NSF Standard 53 for VOC reduction. Analyte-free water will be used for all blank preparations was well as final decontamination rinses. Analytical results from method blanks and/or sample equipment blanks are documented to demonstrate the reliability and purity of analyte-free water sources. Analyte free water is stored and transported in either glass or High-Density Polyethylene (HDPE) containers, depending on its intended use.

Sampling container sets are assembled in the laboratory prior to transportation to the sampling site. If a preservative has been added to the container, it is noted on the container. Fresh preservatives are obtained from stocks prior to the assemblage of each container set. Samples are preserved as specified in Tables 6-9 and 6-10.

Reagents, standards, and solvents are maintained, stored and transported in a manner that considers the grade of reagents, potential for contamination, and safety.

Duplicates are collected by sampling from successively collected volumes (i.e., samples from the next bailer of sample water).

Split samples are taken from consecutive sample volumes from the same sampling device (e.g., samples from the same bailer) or by mixing in a large intermediate vessel. Note: for large volume samples that may require more than one full bailer, the first half volume of the first bailer full is poured into the first container, and the second half is poured into the second container; then the first half volume of the second bailer full is poured into the second container, and the second half is poured into the first container. This procedure is continued until both containers are full.

In general, sample collection equipment is triple-rinsed with sample water before the actual sample is taken.

The pH will be checked for acid or base preserved samples with narrow range pH paper for all samples per each parameter on the first sampling event, and on one sample per each parameter for all successive events at the same site. Any additional chemicals used to augment preservation are documented on the COC.

Careful attention is given to the collection of VOCs. Aqueous and solid samples should never be mixed or composited in the field unless called for in an approved Project Plan. Soil samples are collected using a variety of possible procedures depending on project requirements. Liquid samples are collected using a bottom draining bailer or by pouring the sample slowly down the inside edge of the sample vial to minimize aeration. The VOC vials are filled to the point of creating a convex meniscus. The cap of the vial is secured with the Teflon side of the septum contacting the sample. To check for headspace, the vial is inverted and lightly tapped. If air bubbles are present, more sample is added to the vial and again checked for air bubbles. Additional sample can only be added a maximum of three times. If unsuccessful, the sample, vial and septum are discarded. A new vial is used and the collection procedure begins again. Oil and grease and TRPH samples are collected in a well-mixed area of the sampling site and never from the surface of the water. Oil and grease and TRPH samples should not be composited.

Following the collection of the samples, the samples are placed in insulated coolers containing wet ice and, if necessary, materials to avoid breakage. VOC samples from different locations may be placed into the same cooler to reduce the number of trip blanks required, provided that the samples are segregated (multiple vials from the same sampling site are placed into the same container, usually Ziplock bags or cans containing vermiculite). The samples are then transported to the laboratory by the sampling team or shipped by commercial carrier. Field generated wastes, with the exception of purge waters from groundwater monitoring wells, are segregated and containerized by the field personnel and returned to the laboratory for proper disposal. These wastes include solvents; acids and other chemicals that are used as a part of the cleaning/decontamination process, and other miscellaneous wastes that the sampling crew may generate. The purge water from the well can be containerized and disposed of according to the client specifications.

The field personnel are responsible for maintaining records for each sampling event. This is accomplished by using detailed field data sheets. The Field Services Form (Figure 6.2) is used to record grab and composite sampling practices for wastewater sampling. Field notes are handwritten for the collection of groundwater, surface water, soil and sediments. Field notes contain all pertinent information regarding the sampling event.

6.3.1 Cleaning Procedures

6.3.1.1 Laboratory Cleaning Procedures for Field Equipment

a) Cleaning Procedures for Teflon or Glass Field Sampling Equipment Used for the Collection of Samples for Trace Organic Compounds and/or Metals Analysis[1].

1. Equipment is washed thoroughly with Liquinox laboratory detergent or equivalent and hot tap water using a brush to remove any particulate matter or surface film.
2. Rinse equipment thoroughly with tap water twice.
3. Rinse equipment thoroughly with analyte-free water.
4. Rinse the Teflon or glass sampling equipment thoroughly with tap water in the field as soon as possible after use.

b) Cleaning Procedures for stainless steel or metal sampling equipment used for the collection of samples for trace organic Compounds and/or metals analysis[2].

1. Wash equipment thoroughly with Liquinox laboratory detergent or equivalent and hot tap water using a brush to remove any particulate matter or surface film.
2. Rinse equipment thoroughly with tap water twice.
3. Rinse equipment thoroughly with analyte-free water.
4. Rinse the stainless steel or metal sampling equipment thoroughly with tap water in the field as soon as possible after use.

6.3.1.2 Cleaning Procedures for Automatic Sampling Equipment

a) ISCO Automatic Sampler

1. The exterior and accessible interior (excluding the waterproof timing mechanism) portions of automatic samplers are washed with Liquinox laboratory detergent or equivalent and rinsed with hot tap water.
2. The face of the timing case mechanism will be cleaned with a clean damp cloth.
3. All tubing (sample intake and pump tubing) is-triple rinsed with tap water or, if necessary,-discarded after use.
4. New pre-cleaned, silastic pump tubing is installed, if necessary.

b) All Automatic Sampler Headers

1. Disassemble header and using a bottlebrush, wash with hot tap water and Liquinox laboratory detergent or equivalent.
2. Rinse thoroughly with tap water twice.
3. Rinse thoroughly with analyte-free water.
4. Reassemble header-and let dry thoroughly.

c) Reusable Glass Composite Sample Containers and Plastic Reusable Composite Sample Containers[3,4].

1. Wash containers thoroughly with hot tap water and Liquinox laboratory detergent or equivalent, using a bottle brush to remove particulate matter and surface film.
2. Rinse containers thoroughly with tap water twice.
3. Rinse containers thoroughly with analyte-free water.

6.3.1.3 Cleaning Procedures for Sample Tubing

a) Silastic Rubber Pump Tubing Used in Automatic Samplers and Other Peristaltic Pumps.

   1. Flush tubing with tap water and Liquinox laboratory detergent or equivalent.
   2. Rinse tubing thoroughly with tap water two times.
   3. Rinse tubing with analyte-free water.
   4. Install tubing in automatic sampler or peristaltic pump.

6.3.1.4 Miscellaneous Equipment Cleaning Procedures

a) Well sounders and Tapes Used to Measure Ground Water Levels[5]

   1. Wash with Liquinox laboratory detergent or equivalent and hot tap water.
   2. Rinse equipment thoroughly with tap water.
   3. Rinse equipment thoroughly with analyte-free water.

b) Augers and Soil Boring Equipment

   1. Wash thoroughly with Liquinox laboratory detergent or equivalent, and hot water using a brush to remove any particulate matter or surface film.
   2. Rinse equipment thoroughly with tap water two times.
   3. Rinse equipment thoroughly with analyte-free water.

c) Miscellaneous Sampling and Flow Measuring Equipment

   Miscellaneous flow measuring and sampling equipment shall be washed with Liquinox laboratory detergent or equivalent, rinsed with hot tap water twice, followed by a thorough deionized water rinse, and dried before being stored. This procedure is not used for any equipment utilized for the collection of samples for trace organic compounds or metals analyses.

d) ISCO Flow Meters, Field Analytical Equipment, and Other Field Instrumentation

   The exterior of sealed, watertight equipment, such as ISCO flow meters, should be washed with Liquinox laboratory detergent or equivalent, and rinsed with hot tap water before storage. The interior of such equipment may be wiped with a damp cloth if necessary.

   Other field instrumentation should be wiped with a clean, damp cloth: pH meter probes, conductivity probes, DO meter probes, etc. should be rinsed with deionized water before storage.

   The desiccant in flow meters and other equipment should be checked and replaced if necessary each time the equipment is cleaned.

6.3.1.5 Cleaning Procedures for Field Vehicles

All vehicles utilized by field personnel should be washed (if possible) at the conclusion of each sampling event. This routine maintenance should minimize any chance of contamination of equipment or samples due to contamination of vehicles. All vehicles are equipped with trash containers to facilitate vehicle cleaning. All field personnel are responsible for keeping the vehicles clean by removing all trash and other debris before it accumulates. All contaminated trash and equipment must be kept separate from ordinary trash and must be disposed of properly on-site or upon return to the laboratory.

a) Equipment Used for Routine Sample Collection Activities

For routine operations involving conventional parameter analyses, water quality sampling equipment such as grab samplers, buckets, etc., may be cleaned with sample or deionized water between sampling locations. A brush may be used to remove deposits of material or sediment, if necessary. If deionized water is used, water samplers should be flushed with sample at the next sampling location before the next sample is collected. It should be emphasized that these procedures cannot be used to clean equipment for the collection of samples for organic compounds, trace metals analyses, oil and grease, TRPH or bacteriologicals.

Flow measuring equipment such as weirs, velocity meters and other stream gauging equipment may be cleaned with tap water after use between measuring locations.

6.3.1.7 Keys to Restrictions Noted Above

1. When this sample equipment is used to collect samples that contain oil, grease or other hard to remove materials, it may be necessary to rinse the equipment several times with pesticide-grade acetone or hexane to remove the materials before proceeding with Step 1. In extreme cases, it may be necessary to steam clean the field equipment before proceeding with Step 1. If the field equipment cannot be cleaned utilizing these procedures, it should be discarded.
2. When this sampling equipment is used to collect samples that contain oil and grease or other hard to remove materials, it may be necessary to rinse the equipment several times with pesticide-grade acetone or hexane to remove the materials before proceeding with Step 1. In extreme cases, when equipment is painted, badly rusted or coated with materials that are difficult to remove, it may be necessary to steam clean, wire brush, or sandblast equipment before proceeding with Step 1. Any stainless steel sampling equipment that cannot be cleaned using these procedures should be discarded.
3. When these containers are used to collect samples that contain oil and grease or other hard to remove materials, it may be necessary to rinse the container several times with pesticide-grade acetone before proceeding with Step 1. If these materials cannot be removed with acetone, the container should be discarded. Glass reusable composite containers used to collect samples from pesticide, herbicide or other chemical manufacturing facilities that produce toxic or noxious compounds shall be disposed of properly (preferably at the facility) at the conclusion of sampling activities and will not be returned for cleaning. Also, glass composite containers used to collect in-process wastewater samples at industrial facilities should be discarded after sampling. Any bottles that have visible film, scale or discoloration remaining after this cleaning procedure will also be discarded.
4. Plastic reusable sample containers used to collect samples from facilities that produce toxic or noxious compounds, or used to collect in-process waste steam samples at industrial facilities will be disposed of properly (preferably at the facility) at the conclusion of the

sampling activities and will not be returned for cleaning. Any plastic composite sample containers that have a visible film, scale or other discoloration remaining after this cleaning procedure will be discarded.

5. The same procedure applies whether this equipment is cleaned in the laboratory or in the field.

6.3.1.8 In-Field Equipment Cleaning Procedures

a) Cleaning Procedures for Teflon or Glass Field Sampling Equipment Used for the Collection of Samples for Trace Organic Compounds and/or Metals Analysis.

1. Equipment is washed thoroughly with Liquinox laboratory detergent or an equivalent and tap water using a brush to remove any particulate matter or surface film.
2. Rinse equipment thoroughly with tap water.

b) Cleaning Procedures for Stainless Steel or Metal Sampling Equipment Used for the Collection of Samples for Trace Organic Compounds and/or Metals Analysis.

1. Wash equipment thoroughly with Liquinox laboratory detergent or equivalent and tap water using a brush to remove any particulate matter or surface film.
2. Rinse equipment thoroughly with tap water.
3. Rinse equipment thoroughly with deionized water.

c) Cleaning Procedures Sampling Equipment Used for the Collection of Inorganic Ions (SO4, SO3, SO2, NO3, NO2, PO4).

1. Rinse equipment with analyte-free water.
2. Rinse equipment with sample water.

d) Cleaning Procedures for Equipment Used for Routine Sample Collection Activities.

For routine operations involving conventional parameter analyses, water quality sampling equipment (i.e., grab sampler, buckets, etc.) may be cleaned with sample or deionized water between sampling locations. If necessary, a brush may be used to remove deposits of material or sediment. If deionized water is used, water samplers should be flushed with sample at the next sampling location before the sample is collected. These procedures cannot be used to clean equipment for the collection of samples for organic compounds, trace metals analyses, oil and grease, TRPH or microbiologicals.

Flow measuring equipment such as weirs, velocity meters, and other stream gauging equipment should be cleaned with tap water after use between measuring locations.

6.3.2 Sampling Protocols

6.3.2.1 Wastewater Influent and Effluent

a) Sampling Equipment

A descriptive list of equipment used for the sampling of wastewater influents and effluents is presented in Table 6-2.

b) Sample Handling and Compositing

Sampling of wastewater influents and effluents should reflect the characteristics of the waste over normal operating cycles. Grab samples may be suitable for batch processes or for uniform effluent streams. For most cases a composite sample will be necessary. Composite samples can be obtained manually or with an automatic sampling device in either a time or flow proportioned mode. The quantity of each collected sub-sample is recorded on the field data sheets. Sub-samples collected for the analysis of trace organics (excluding VOCs) or metals will be mixed with glass, stainless steel or Teflon equipment. Compositing is accomplished by mixing the sub-samples together thoroughly prior to dividing the composited sample into containers used for analysis (VOCs are not to be composited except when specified by client request)

1. Grab Samples

   Grab sampling is conducted when:

   A. The water or wastewater stream is not continuous (i.e., batch-discharges or intermittent flow);
   B. The characteristics of the water or waste stream are known to be constant or nearly so;
   C. The sample is to be analyzed for parameters whose characteristics are likely to change significantly with time (i.e., dissolved gasses, bacteria, etc.);
   D. The sample is to be collected for analysis of a parameter such as oil and grease where the compositing process could significantly affect the actual concentration; and
   E. Data on maximum/minimum concentrations are desired for a continuous water or wastewater stream.

   Samples of water that shall always be collected on a grab basis or for which measurements shall be made in-situ include:

pH	Phenol
Temperature	Oil and Grease
Dissolved Oxygen	Bacterial
Sulfide	Volatile Organic Compounds
Residual Chlorine	Specific Conductance
Cyanide	Other Dissolved Gases

2. Composite Samples

   A. Timed Composite - A sample containing a minimum of eight equal, discrete samples collected at equal time intervals over the compositing period. Timed composites may be collected where water or wastewater flows vary widely and are not dampened by wastewater treatment units.
   B. Flow Proportional Composite - A sample containing a minimum of eight discrete samples collected proportional to the flow rate over the compositing period. Flow proportional samples may be collected where water or wastewater flows vary widely and are not dampened by wastewater treatment units.
   C. Timed and Flow Proportional Composite Samples – The following guidance is given concerning the collection of composite samples:

a. Composite samples are collected when average waste concentrations are of interest and are associated with average flow data (where appropriate).

b. Composite sampling is used when the water or wastewater stream is continuous, when it is necessary to calculate mass/unit time loadings, or when analytical capabilities are limited.

c. A timed composite is collected continuously or with a constant sample volume and a constant time interval between samples.

d. A flow proportional composite is collected continuously (proportional to the stream flow), with constant sample volume and the time between samples proportional to the stream flow or with a constant time interval between samples and the sample volume proportional to flow at the time of sampling.

c) Preliminary Site Preparation

Where applicable, wastewater influent samples should be collected at the location specified in the NPDES permit. If the source does not have such a permit, the field personnel will select a sampling point where the most representative sample may be collected.

The following protocols are employed for sampling site selection for wastewater influents. A point of highly turbulent flow, near the center of the flow channel, is the most preferred. If this location is inaccessible, the sample will be collected from either the upflow siphon following a comminutor, the upflow distribution box following pumping from a main plant wet well, the aerated grit chamber, the flume throat or the pump wet well when the pump is operating.

The sampling site for wastewater effluents will be as stated in the NPDES permit. If no site is specified in the permit the point of sampling will be at the most representative site downstream from all entering wastewater streams prior to discharge into the receiving waters. When samples are collected from receiving waters it will be necessary to collect composite samples unless homogeneous mixing can be demonstrated. Samples should not be collected from the surface or from the bottom of any wastewater stream or receiving waters.

Sampling Procedures

1. Manual Sampling by Grab

   A. The decontaminated grab sampler is lowered into the wastewater stream and rinsed once with sample water (pre-rinse is not done for the sampling of oil and grease, TRPH, VOCs or bacteriologicals).
   B. The grab sampler is again lowered into the wastewater stream and allowed to fill up.
   C. The full grab sampler is removed from the wastewater stream.
   D. Precleaned sample containers are then filled with the sample.
   E. The samples are assigned sample descriptions that are recorded on the Field Services Form (Figure 6.2) or the COC with the time and location of the sampling.
   F. The pH-preserved samples are checked with narrow range pH paper to assure a proper pH.

G. If the pH of the preserved samples is incorrect, additional preservative is added until the proper pH is observed. The amount of preservative added is noted on the COC along with the sample description of the sample needing the pH adjustment.
H. The samples are placed in coolers containing wet ice for transportation back to the laboratory.
I. The pH, temperature, and conductivity of the samples are field measured, if requested by the client.

2. Grab Sampling at a Specific Depth

A. The total depth of the water column at the sampling point is measured using a sounding device and/or measuring device. The total depth is recorded on the field data sheet.
B. The dissolved oxygen, temperature, pH and conductivity/salinity of the water at the depth of sampling is determined (if requested by the client) and recorded on the field data sheet.
C. A previously decontaminated sampler is lowered into the water column to the specified depth for that sample.
D. The messenger for the sampler is dropped.
E. The sampler is removed from the water and precleaned sample containers are filled.
F. The samples are assigned sample descriptions, which are recorded on the Field Services Form (Figure 6.2) or the COC with the time and location of the sampling.
G. The pH-preserved samples are checked with narrow range pH paper to assure a proper pH.
H. If the pH of the preserved samples is incorrect, additional preservative is added until the proper pH is observed. The amount of preservative added is noted on the COC along with the sample description of the sample needing the pH adjustment.
I. The samples are placed in coolers containing wet ice for transportation back to the laboratory.
J. The sampler is rinsed with deionized water prior to re-use at another depth or location. The sampler is also rinsed with sample prior to subsequent sampling. Exceptions include samples collected for bacteriologicals, oil and grease, TRPH or VOCs.

3. Automatic Sampling in the Flow Proportioned Mode

A. The decontaminated automated sampler is programmed and evaluated in the laboratory to assure proper operation prior to transportation to the sampling site.
B. The automated sampler is positioned on a flat surface at the sampling site and the sample collection tubing is positioned in the wastewater stream.
C. The automatic sampler is refrigerated by placing ice around the sample container(s).
D. The automated sampler and/or flow meter are then activated and the time of activation is recorded on the Field Services Form (see Figure 6.2).
E. The sample container(s) are retrieved from the sampling site. The date and time of retrieval is recorded on the Field Services Form (see Figure 6.2).
F. The temperature of the sample is checked at the sampling site. The temperature of the sample is recorded on the field data sheet.
G. The sample(s) are removed from the automated sampler and the composite sample is transferred into appropriate preserved bottles.
H. The composite sample bottles are assigned sample descriptions, placed in a cooler containing wet ice and transported to the laboratory.

4. Automatic Sampling/Time Mode

   A. The decontaminated automated sampler is programmed and evaluated in the laboratory to assure proper operation.
   B. The automated sampler is positioned on a flat surface at the sampling site and the sample collection tubing is positioned in the wastewater stream.
   C. The automated sampler is refrigerated with ice placed around the sample container(s).
   D. The automated sampler is activated and the time of activation is recorded on the Field Services Form (see Figure 6.2).
   E. The sample container(s) are retrieved from the sample site. The date and time of retrieval is recorded on the Field Services Form (see Figure 6.2).
   F. The temperature of the sample(s) checked in the field are recorded on the Field Services Form (Figure 6.2) or the COC.
   G. The sample(s) are removed from the automated sampler and transferred into appropriate preserved bottles.
   H. The sample bottles are assigned sample descriptions, placed in a cooler containing wet ice and transported to the laboratory.

6.3.2.2 Surface Water Sampling

a) Sampling Equipment

A descriptive list of equipment used for the collection of surface water samples is presented in Table 6-3.

b) Sample Handling and Compositioning

Surface water samples may be obtained from a number of distinctly different water systems. Each system will dictate the conditions necessary to obtain a representative sample. These will include such factors as water classification, point source discharges, non-point source discharges, small streams, rivers, estuaries, lakes, ponds and impoundments. The characteristics of the body of water to be sampled will dictate the sampling techniques. Care is taken not to disturb sediments in the immediate area of sample collection

Preliminary Site Preparation

1. Ditches and Small Streams

   Road culverts or bridge stations are suitable locations to obtain free flowing well-mixed samples. Dippers (plastic, glass, Teflon) are normally used depending on the stream characteristics and objectives of the sampling program. These systems are usually well mixed and the water quality is uniform across the streambed. Sampling in flow restricted areas will be avoided whenever possible.

2. Rivers, Streams and Tributaries

   Large flowing bodies of water may exhibit significant differences in water quality along a cross sectional transect. Careful consideration of the location of sampling stations and water depths to be sampled should be done prior to starting the sampling program. As a general rule, mid-stream/mid-depth samples will be taken.

c) Sampling Procedures

1. Manual Sampling by Grab

   A. The decontaminated grab sampler is lowered into the water and rinsed once with sample water (pre-rinse is not done for the sampling of oil and grease, TRPH, VOCs or bacteriologicals).
   B. The grab sampler is again lowered into the water and allowed to fill up.
   C. The full grab sampler is removed from the water.
   D. Cleaned sample containers are filled with sample.
   E. The samples are assigned sample descriptions, which are recorded on the Field Services Form (Figure 6.2) or the COC with the time and location of the sampling.
   F. The pH-preserved samples are checked with narrow range pH paper to assure a proper pH.
   G. The samples are placed in coolers containing wet ice for transportation back to the laboratory.
   H. The pH, temperature and conductivity of the samples are measured in the field parameter measurement cup. These measurements are then recorded on the Field Services Form (Figure 6.2) and COC.

2. Grab Sampling at a Specific Depth

   A. The total depth of the water column at the sampling point is measured using a sounding device and measuring tape and the total depth is recorded on the Field Services Form (Figure 6.2) or the COC.
   B. The dissolved oxygen, temperature, pH, and conductivity/ salinity of the water at the depth of sampling is determined and recorded on Field Services Form (see Figure 6.2).
   C. A decontaminated sampler is lowered into the water column to the specified depth for that sample.
   D. The messenger for the sampler is dropped.
   E. The sampler is removed from the water and pre-cleaned sample containers are filled.
   F. The samples are assigned sample descriptions, which are recorded on Field Services Form (Figure 6.2) or the COC with the time and location of the sampling.
   G. The pH-preserved samples are checked with narrow range pH paper to assure a proper pH.
   H. The samples are placed in coolers containing wet ice for transportation back to the laboratory.
   I. The sampler is then rinsed with deionized water prior to re-use at another depth or location. The sampler will also be sample rinsed prior to subsequent sampling unless the samples collected are to be analyzed for bacteriologicals, oil and grease, TRPH or VOCs.

d) Special Sampling Procedures

Samples requiring analysis for dissolved metals or dissolved Ortho-phosphate will be filtered in the field at the time of collection, whenever possible. Field filtering of samples will be recorded on the field data sheet
and the sample container

6.3.2.3 Ground Water/Well Monitoring Sampling

a) Sampling Equipment

A descriptive list of equipment used for the collection of ground water from monitoring wells is presented in Table 6-4.

b) Sample Handling and Compositing

Monitoring wells exhibit a wide range of well characteristics, well depths, well diameters, recovery times, and materials of construction. The monitoring well casings should be enclosed in a protective sleeve and be capped and locked when not being sampled.

Water levels are measured in the field with an electronic level detection meter. The water level will be measured from the same point for each sampling event. Measurements should be accurate to within $1/10^{th}$ of a foot, except when more stringent measurements are called for in the project plan.

The basic goals for the sampling of monitoring wells is to remove stagnant casing water and allow a representative portion of groundwater to re-charge the well prior to sampling. This is accomplished by purging five well volumes, purging dry or purging three well volumes with subsequent stabilization of pH, conductivity and temperature prior to sampling. Stabilization is determined as two consecutive reading values within five percent of each other. The following is the calculation used to determine the well volume:

$$V = (r^2)(0.1632)(h)$$

Where: V = Volume in gallons

r = Radius of well in inches

h = Depth of water in feet

0.1632= [(p)/144] * 7.48052

Where: p = 3.1416

144 = conversion of square inches to feet

7.48052 = conversion of cubic feet to gallons

Purging of the well begins just below the top of the water level. The purging equipment is lowered into the well to follow the water level as it falls. The maximum time between purging and sampling is 24 hours.

Before sampling can begin, it may be necessary to place protective covering, such as plastic sheeting on the ground around the well head. Wells that do not require analysis for organics are sampled with a PVC, HDPE, or Teflon bailer.

Monitoring well samples which require analysis for organic parameters will be sampled with laboratory decontaminated Teflon bailers whenever possible. Bailers manufactured of other materials such as PVC or HDPE may be used with the client's consent. In such cases, an equipment blank will be collected from a representative bailer to determine any possible contamination levels.

c) Purging and Sampling Procedures

Bailer

1. Determine the water volume in the well.
2. Measure the distance from the bottom of the well to the static water level.
3. Measure the inside diameter of the well or casing.
4. Calculate the well volume and record the results on the field data sheet.
5. Remove water from the well until five well volumes are purged, the well is purged dry or until three well volumes are purged with subsequent stabilization of pH, conductivity, and temperature.
6. Samples are then collected using another pre-cleaned bailer or with the bailer used for purging after it is cleaned as outlined in field cleaning procedures.
7. An equipment blank is collected to determine the adequacy of cleaning prior to the collection of any sample, if requested by the client.
8. Pre-cleaned containers are then filled with the samples.
9. The samples are assigned sample descriptions that are recorded on the Field Services Form (Figure 6.2) or the COC with the time and location of the sampling.
10. The pH-preserved samples are checked with narrow range pH paper to assure a proper pH.
11. The samples are placed in coolers containing wet ice for transportation to the laboratory.

6.3.2.4 POTABLE WATER SAMPLING

a) Sampling Equipment

No specific sampling equipment is used. Grab samples are collected directly into appropriate containers.

b) Sample Handling and Compositing

Drinking Water Supply Systems will be sampled with care to avoid contamination and to assure that a representative sample is collected. This is important not only from a technical and public health perspective, but also from a public relations standpoint. Poor sampling techniques may result in incorrect results. If incorrect results are disclosed to the public, it may be impossible to change public opinion when correct results are reported. Grab samples are generally collected and analyzed. Compositing may be (in some cases) done in the laboratory.

c) Preliminary Site Preparation

Potable water samples are taken to assess water quality within a given segment of the distribution network. Taps selected for sample collection should be supplied with water from a service pipe connected directly to a water main in the segment of interest, and should not be separated from the segment of interest by a storage tank. The sampling tap must be protected from exterior contamination associated with being too close to the sink bottom or to the ground. Aerator, strainer, and hose attachments on the tap must be removed before sampling to reduce the risk of bacteriological contamination. Only taps where the water flow is steady will be sampled.

Before a sample may be collected, the line must be purged to remove all standing water. Purging should commence at maximum velocity for a minimum of fifteen minutes (for unknown well volumes), or for the volume of the holding tank (if known). For intermittently running pumps, purging should commence at maximum velocity for a minimum of fifteen minutes (for unknown well volumes) and with stabilization of pH, conductivity, and temperature (two consecutive measurements with five percent). Flow rate from the faucet should be reduced to approximately 500mL per minute for sample collection.

When sampling potable water from the water treatment plant, samples are collected from the raw water supply and also following chlorination.

d) Sampling Procedures

1. Routine Sample Collection

A. The exact location of the tap being sampled, along with the date and name of the sampler(s) is recorded on the field data sheet.
B. Remove any attachments from the tap.
C. The cold water is turned on and allowed to flow in a steady stream for a minimum of 15 minutes.
D. Samples are collected.
E. The samples are assigned sample descriptions that are then recorded on the Field Services Form (Figure 6.2) or the COC.
F. The samples are placed in an cooler containing wet ice for transportation back to the laboratory.

2. Collection for Lead and Copper Analysis (For Lead and Copper Rule)

A. The water is allowed to sit in the pipes for a minimum of eight hours.
B. Collect 1L of first draw water from spigot inside building.
C. The samples are assigned sample descriptions that are then recorded on the Field Services Form (Figure 6.2) or the COC.
D. The samples are then transported to the laboratory.
E. Samples are preserved with 1:1 Nitric Acid to pH < 2.

6.3.2.5 SEDIMENTS, SOIL, RESIDUAL, and SOLID WASTE SAMPLING

a) Sampling Equipment

A descriptive list of equipment used for the collection of sediments, soils and residuals is presented in Table 6-5.

b) Sample handling and compositing sediments samples from surface water systems may be completed for different purposes. Sediment samples for chemical analysis can be collected by scooping surface material into a wide mouth container. Core samples may also be obtained. Core samples are used to sample a vertical portion of sediment. Coring devices can be used with glass or Teflon liners for sampling of sediment material for organic analysis. Core samplers can be push tube or weight driven, depending on the nature of the substrate to be sampled. All sediment grab samples are well mixed (except VOCs) before containerization. Samples collected for the analysis of VOCs will not be composited, except when specified by the regulating authority.

Disturbed portions of samples collected by augers or split spoon samplers will be discarded and not taken as part of the sample. Samples for chemical analysis are not taken from auger flights or cuttings from hollow stem auger flights. Samples used for geological, lithological, or vapor meter determinations are not used for trace contaminant analysis.

c) Preliminary Site Preparation

1. Sediment Samples From Surface Water Systems

In order to obtain a representative sediment sample from a surface water system, a grid of the area to be sampled is first constructed. The sample sites are then selected at random from the grid.

2. Soil Samples

Areas selected for soil sampling are strategically located in order to collect a representative fraction of the soils with the minimum number of samples and effort. A surface inspection of the subject area will be made to located pertinent features such as wet areas, permanent structures, fill areas, and erosional and depositional areas. An evaluation will then be made to access the relationship between these features and potential sources of pollution. After this initial evaluation is complete, several surface or near-surface samples will be taken and analyzed for the contaminants in question. This will serve as a screening procedure. Sampling of this type will be conducted in depositional areas on the periphery of the study area, primarily at the downstream samples or down gradient portion of the area of interest. An upgradient location will also be selected for obtaining background and/or control.

A more in-depth investigation will be conducted after the above screening procedure is complete. The number of samples and the number of test pits and/or borings and the specific depth that samples are collected can then be determined and the project sampling will begin.

3. Municipal Sludge Samples

Municipal sludge may be collected from several areas. Municipal sludge being drawn to a drying bed will be collected from the pipe flowing to the sludge bed or at the discharge point into the bed. To account for variations in the sludge concentrations and consistency, a minimum of three aliquots of the sludge will be collected during the draw period.

Municipal sludge from an anaerobic digester will be collected from sample ports in the recirculation lines or from "thief holes" in the floating top of the digester.

Municipal sludge from an aerobic digester will be collected while the contents of the digester are being mixed from the 1/3 - 2/3 depth zone.

Municipal sludge can also be collected from a quiescent holding basin. In this case, it is impossible to collect one sample that will be representative of the total contents of the basin since the material is generally stratified. It will therefore be necessary to collect a minimum of three samples that will be composited prior to chemical analysis. These samples will be collected from a platform or boat using sediment-sampling devices.

Municipal sludge from drying beds will be collected using a stainless steel spoon, shovel, or similar device. Samples will be collected from more than one location in the drying bed to insure a representative sample. The sample should be collected from the entire depth of the sludge on the bed.

4. Solid Waste Samples

Sampling locations should be selected which will yield a sample that is representative of the solid waste being investigated. While a representative sample from a small solid waste area can often be obtained by collecting a single sample, the collection of a representative sample(s) from large waste piles is much more difficult. For the sample(s) to be representative, a statistical approach will be used in the selection of both the number of samples and the location where they are to be collected. This statistical approach involves the mapping out of the solid waste pile in a three-dimensional grid. Sample locations and depths will then be randomly selected from this grid.

d) Sampling Procedures

1. Surface Soil Sampling for Non-Volatile Samples

   A. Carefully remove leaves, grass and surface debris with a pre-cleaned stainless steel spoon or shovel.
   B. Collect samples with a pre-cleaned stainless steel scoop or spoon.
   C. Place sample in a pre-cleaned stainless steel or glass pan for mixing.
   D. Fill pre-cleaned sample containers completely with well-mixed sample with no headspace and tightly cap.
   E. Assign the sample a sample description and record with sample location and time on field data sheet. Sample description and time of collection are recorded on the COC.
   F. Place the sample in a cooler containing wet ice for transportation to the laboratory.

2. Shallow Subsurface Sampling for Non-Volatile Samples

   A. Carefully remove leaves, grass and surface debris with a pre-cleaned stainless steel spoon or shovel.
   B. Dig a hole or trench with a stainless steel shove.
   C. Remove the loose soil from the hole or trench.
   D. Collect the sample at the desired depth with a pre-cleaned stainless steel spoon, a stainless steel hand auger, or a Shelby tube.
   E. Place the sample in a pre-cleaned stainless steel or glass pan for mixing.
   F. Fill pre-cleaned sample containers with well-mixed sample, allowing for no headspace and tightly cap.
   G. Assign the sample a sample description and record along with the sample location and time on the field data sheet. Sample description and time of collection are recorded on the COC.
   H. Place the sample in a cooler containing wet ice for transportation back to the laboratory.

3. Deeper Subsurface Soil Sampling for Non-Volatile Samples

A. Carefully remove leaves, grass and surface debris with a pre-cleaned stainless steel spoon or shovel.
B. Bore a sampling hole to the desired depth with a pre-cleaned stainless steel auger.
C. Collect the sample with another clean auger bucket or Shelby tube.
D. Place the sample in a pre-cleaned stainless steel or glass pan for mixing.
E. Fill pre-cleaned sample containers with well-mixed sample, allowing for no headspace.
F. The samples are assigned sample descriptions that are then recorded on the Field Services Form (Figure 6.2) or the COC.
G. The samples are placed in a cooler containing wet ice for transportation back to the laboratory.

4. Surface, Shallow and Deeper Subsurface Soil Sampling for Volatile Samples

A. Follow site preparation and sample retrieval steps in Sections A, B, and C above.
B. Using an EnCore™ sample collection device (or equivalent), collect approximately 5 g of sample as soon as possible after the surface of the soil has been exposed to the atmosphere: generally within a few minutes at most.
C. Collect at least two replicate EnCore™ samples from the same soil stratum or the same section of the solid waste being sampled, and with close proximity to the location from which the original sample was collected.
D. Collect an additional aliquot of the sample in a pre-cleaned 4 oz glass jar with a Teflon lined lid or 40 ml VOC vial. Fill sample container allowing for no headspace.
E. The samples are assigned sample descriptions that are then recorded on the Field Services Form (Figure 6.2) or the COC.
F. The samples are placed in a cooler containing wet ice for transportation back to the laboratory.

6.3.2.6 MICROBIOLOGICAL SAMPLING

a) Sampling Equipment

A descriptive list of equipment used for the collection of microbiological specimens is presented in Table 6-6.

b) Sample Handling

All microbiological sampling is done under sterile conditions. Samples are collected in pre-sterilized, commercially available containers. These containers are sealed at the manufacturer and are not opened until sampling. Microbiological samples are never composited.

c) Preliminary Site Preparation

The minimum number of microbiological samples that adequately represent the sampling site are collected. The location and number of samples to be collected is predetermined before sampling begins and will meet the requirement necessary to determine water quality. Microbiological samples can be collected from potable water, surface water, groundwater, wastewater treatment plants, and hazardous waste sites. Refer to these sections for more detailed information concerning preliminary site preparation.

d) Sampling Procedures

Samples are collected by hand. The sample bottle contains a dechlorinating agent, usually sodium thiosulfate. In no case is a composite sample collected for bacteriological examination.

1. Surface Sampling By Hand

   A. Open bottle or Whirl-Pak.
   B. Lower the sample container into the water.
   C. Move the sample container horizontally away from the sampler's body.
   D. Tip the container upwards and remove from the water, allow 1-2 inches of air space.
   E. Seal the container and record the field ID number on the field data sheet.

6.3.2.7 LIQUID WASTES and DRUM

a) Sampling Equipment

A descriptive list of equipment used for the collection of liquid hazardous wastes and drum samples is presented in Table 6-7. Sampling equipment to collect hazardous samples should be disposable or easily decontaminated. The equipment should be easy to operate, because personnel may be wearing cumbersome safety clothing and respiratory equipment.

b) Sample Handling and Compositing

When collecting liquid wastes or drum samples, it is advisable to collect only grab samples. Compositing samples poses a safety risk if it involves samples of unknown hazardous content. The chemical changes that may occur during compositing also support collection of grab samples. Compatibility testing must be performed prior to sample compositing for potentially hazardous materials.

Sampling of closed containers (drums, barrels, and tanks) should only be conducted when absolutely necessary. When container sampling is necessary, the first priority should be the collection of samples from open containers. Open containers generally present less hazard to the samplers than closed containers (i.e., volatile components have already evaporated, and extreme acute toxicity would probably be evident from dead animal life or vegetation around the site). Closed containers must be considered as extremely hazardous from toxicity, explosion, and fire standpoints. Chronic toxicity may be a danger in both open and closed containers. Because of the dangers involved with container sampling, the sampling of drums, barrels, or the containers containing either unknown material or known hazardous material shall be considered a hazardous duty.

A problem, which often arises in container sampling, is stratification and/or phase separation of the container contents. When this condition occurs or is suspected, care must be taken to insure that the sample collected is representative of the container contents. If only one layer or phase is sampled, this should be noted and taken into account when interpreting analytical results.

Where possible, samples should be composited with depth (i.e., collected throughout the entire depth of the container, or at several different depths) to provide a representative sample. When a drum or cylindrical container is standing vertically, depth compositing provides a good quantitative estimate of the container content. In other cases where such containers are tipped, horizontal, or deformed, etc., depth compositing will provide a representative sample at least on a qualitative basis.

Note: A quantitatively representative sample could be collected, but it would require sophisticated sampling methodology involving multi-layer sampling and volume measurements. This is not recommended unless initial screening indicates that it is absolutely necessary.

The Coliwasa is a device employed to sample free-flowing liquids and slurries contained in drums, shallow tanks, pits, and similar containers. It is especially useful for sampling wastes that consist of several immiscible liquid phases. The coliwasa consists of a glass, plastic, or metal tube equipped with an end closure that can be opened and closed while the tube is submerged in the material to be sampled.

Samples from drums or barrels can be collected using a four-foot length of glass tube. In most instances, glass tubes with one-half inch or less inside diameter work best.

Tank trucks and storage tanks containing liquid wastes are a special case. Samples may be collected from access ports on these tanks or trucks using the techniques outlined above. Tank trucks are often compartmentalized, and the field personnel should insure that all compartments of the tank truck are sampled. Sampling from discharge valves usually found on tank trucks is not recommended due to the potential stratification of the tank contents. However, if the investigator has to collect a sample from a tank truck discharge valve, the valve arrangement of the particular tank truck being sampled must be clearly understood to insure that the contents of all compartments are sampled. The same precautions apply to sampling from storage tank valves. In either case, the field personnel must realize that samples obtained from valves (particularly those at or near the bottom of the truck and storage tanks) may not yield representative samples.

c) Sampling Procedures

1. Manual Sampling By Grab

   A. The decontaminated grab sampler is lowered into liquid to be sampled and rinsed once with sample water, except for the sampling of bacteriologicals, oil and grease, TRPH or VOCs
   B. The grab sampler is again lowered into the liquid to be sampled.
   C. The full grab sampler is removed.
   D. Precleaned sample containers are filled with the sample.
   E. The samples are assigned sample descriptions that are recorded on the Field Services Form (Figure 6.2) or the COC with the time and location of the sampling.
   F. The pH-preserved samples are checked with narrow range pH paper to assure a proper pH.
   G. The samples are placed in coolers containing wet ice for transportation back to the laboratory.
   H. The pH, temperature, and conductivity of the samples are measured in the field parameter measurement cup. These measurements are then recorded on the field data sheet.

2. Grab Sampling at a Specific Depth

   A. The total depth of the water column at the sampling point is measured and the total depth is recorded on the field data sheet.
   B. The dissolved oxygen, temperature, pH, and conductivity/salinity of the water at the depth of sampling is determined and recorded on the field data sheet.
   C. A decontaminated sampler is lowered into the water column to the specified depth for that sample.
   D. The messenger for the sampler is dropped.
   E. The sampler is removed from the water and pre-cleaned sample containers are filled.
   F. The samples are assigned sample descriptions, which are recorded on Field Services Form (Figure 6.2) or the COC with the time and location of the sampling.
   G. The pH-preserved samples are checked with narrow range pH paper to assure a proper pH.
   H. The samples are placed in coolers containing wet ice for transportation back to the laboratory.
   I. The sampler is then rinsed with deionized water prior to re-use at another depth or location. The sampler will also be sample rinsed prior to subsequent sampling unless the samples collected are to be analyzed for bacteriologicals, oil and grease, TRPH or VOCs.

3. Bailer

   A. Determine the water volume in the well (for well sampling).
   B. Measure the distance from the bottom of the well to the static water level.
   C. Measure the inside diameter of the well or casing.
   D. Calculate the well volume and record the results on the field data sheet.
   E. Purge the well of five well volumes until purged dry, or three well volumes with subsequent stabilization of pH, conductivity, and temperature.
   F. Pre-cleaned sample containers are then filled.
   G. Proceed with steps 6 through 10 from the previous sampling procedures.

4. Coliwasa Composite Waste Sampler (Coliwasa designs vary)

   A. Put the sampler in the open position by placing the stopper rod handle in the T-position and pushing the rod handle until it sits against the sampler's locking block.
   B. Slowly lower the sampler into the liquid to be sampled so that the liquid level inside and outside of the tube are about the same. If the level inside the sampler tube is lower than the level outside of the sampler, then the sampling rate will be too fast and a non-representative sample will be collected.
   C. When the sampler stopper hits the bottom of the waste container, the tube is pushed downward against the stopper to close the sampler.
   D. Lock the sampler in the closed position by turning the T-handle until it is upright and one end rests tightly on the locking block.
   E. Slowly withdraw the sampler from the liquid being sampled.
   F. Carefully discharge the sample into pre-cleaned sample containers. Open the sampler by slowly pulling the lower end of the T-handle away from the locking block, while the lower end of the sampler is positioned in the sample container.
   G. The sample is assigned a sample description that is recorded on the Field Services Form (Figure 6.2) or the COC.

H. The samples are packaged properly (see special sampling procedures) for transportation.
I. The sampler is wrapped and sealed in either aluminum foil or plastic bags for transportation back to the laboratory for proper disposal or cleaning.

e) Special Sampling Procedures

Any observations (odor, appearance, container labeling, etc.) made by the field personnel should alert the laboratory to potential dangers. The field personnel will provide the laboratory personnel with information on possible constituents in the samples (high concentration, etc.). The information will be documented on the Field Services Form (Figure 6.2) or the COC and explained verbally to the sample custodian.

6.4 Definition of Holding Time

The date and time of sampling documented on the field chain-of-custody (COC) form establishes the day and time zero. When the maximum allowable holding time is expressed in days, the holding time is based on day measured. Holding times expressed in 72 hours or less is measured from date and time zero. The first day of holding time ends twenty-four hours after sampling. Holding times for analyses include any necessary reanalysis.

6.4.1 Semi-Volatile

Holding times for sample preparation for semi-volatile organics are measured from the date of sampling until the extraction solvent contacts the sample. Holding times for analysis are measured from the date of initiation of extraction to the date and time of injection into the gas chromatograph.

6.4.2 Volatiles

Holding times for volatile organics are measured from the date of sampling to the date and time of injection into the gas chromatograph. Extractions, e.g. for high level soils, must be completed in time to allow for analysis to be initiated within the maximum allowable holding time.

6.4.3 Inorganic

For inorganics and metals analysis, with the exception noted below, the preparation/digestion/distillation must be started in time to allow the analysis step to be initiated as documented in the instrument log, instrument output, or analysis worksheet, within the maximum holding time as measured from the sampling date and time. As long as the sample preparation and analytical batches are completed in a continuous fashion, the holding time can be measured to the initiation of sample preparation rather than to the initiation of the analytical step.

6.5 Recommended Containers, Preservation, Holding Times

The preservation and holding time criteria specified in Tables 6-10 and 6-11 are derived from the source documents for the methods. If the method required holding times or preservation requirements are not met, the reports will be qualified using a flag, footnotes, or case narrative. If criteria are not specified in a source document, internal TestAmerica Analytical Testing Corp – Cedar Falls guidelines have been set and are marked with an "*". In the tables, items marked with an "*" will not result in the report data being qualified if the requirement is not met. "Analyze immediately" is an EPA designation reserved for tests which, for compliance monitoring projects, should be performed by field instrumentation or a laboratory "generally within 15 minutes" of sampling (Federal Register, Vol. 48, No. 209, p 11 . TestAmerica Analytical Testing Corp – Cedar Falls will qualify data for these parameters if analysis cannot be performed within 15 minutes of sampling. "ASAP" is an EPA designation for tests for which rapid analysis is advised, but for which neither EPA nor TestAmerica Analytical Testing Corp – Cedar Falls have a basis for a holding time.

Figure 6-1: Bottle Request (Work Order)

Work Order (Internal Use Only)
10/15/2003

ATTN: Contact
Company: Client Information
Address: Client Information
City, State, Zip: Client Information
Phone: Client Information   Account # XXXXX

Author: DLK

Additional Items Included:
Chain of Custody (COC)
Temperature Surrogate
Sampling Instructions
Return Labels
Ice Bags

Project Description: Test
Date Requested By: 10/15/2003

Bottle Type	Quantity	Client Instructions	Lab Notes
Pt. (HNO3) Plastic	10		
Amber 16 oz. (H2SO4)	5		
Qt. (HNO3) Plastic	4		
Purge Vials (No Treat)	3		
16 oz. Jars	1		

Client Instructions

Lab's Special Instructions

Date Shipped:
Shipper's Initials:
Insurance Amount
Cooler ID's
Shipping Weight

TestAmerica Courier

Estimated time for delivery:
Contact BG for time of delivery

Figure 6-1: Bottle Request (Shipping Manifest)

Shipping Manifest (Client Copy)
Not for use as a COC
10/15/2003

ATTN: Contact
Company: Client Information
Address: Client Information
City, State, Zip: Client Information
Phone: Client Information   Account # XXXXX

Author DLK

Additional Items Included:
Chain of Custody (COC)
Temperature Surrogate
Sampling Instructions
Return Labels
Ice Bags

Project Description: Test
Date Requested By: 10/15/2003

Bottle Type	Quantity	Client Instructions
Pt. (HNO3) Plastic	10	
Amber 16 oz. (H2SO4)	5	
Qt. (HNO3) Plastic	4	
Purge Vials (No Treat)	3	
16 oz. Jars	1	

Client Instructions

Date Shipped:
Shipper's Initials:
Insurance Amount
Cooler ID's
Shipping Weight
TestAmerica Courier
Estimated time for delivery:
Contact BG for time of delivery

Figure 6-2: Sampling Instructions

General Sampling Instructions

Sampling containers provided to you by TestAmerica may contain small amounts of required preservative. The preservatives are concentrated and could potentially case harm to any point of contact. Please do not rinse any of these prior to use.

Plastic or Glass Container

- Fill plastic & glass containers to the neck of the bottle.
- Do not over fill your container because there is risk in diluting your preservative.
- Do not under fill your container because the laboratory requires a specific volume to adequately perform your analyses.

Purge Vials

- Fill the purge vial completely full (reverse meniscus). Screw on the cap and check the vial for air bubbles. A properly filled vial will contain no air bubbles.

Soil Jars

- Volatile Analysis: A separate 4 oz. jar should be packed full with as little headspace to prevent volatilization of the analytes of interest. (See special instructions for 5035 sampling technique.)
- Other Analysis: The jar should be packed full, the laboratory requires a specific amount and it is always good practice to provide the laboratory with extra sample in case re-analysis is required.

Chain of Custody (COC)

Please fill out the COC completely and accurately. The laboratory will use this form to determine what tests need to be performed. Incomplete COC will slow down this process and slow the analytical process. Use a blue or black ball point pen and neatly record the necessary information in the spaces provided.

Cooler Packing

- Pack samples in sufficient ice to ensure proper preservation. (> 0 °C to 6 °C)
- Pack samples tightly and securely to prevent breakage
- Make sure COC is filled out, signed, and enclosed in a zip top bag inside the cooler.
- Apply Custody seals
- Tape cooler closed
- Label clearly
- Ship using a method that enables the samples to be received by the laboratory within the allotted holding time and at the required temperature.

If you have any questions or concerns with this document please contact the laboratory.

**Figure 6-3:
Field Services Form**

FIELD NOTES

Field Technician/Sampler's Name:________________________________ Date:______________

Client Name:______________________________ Contact Name:___________________________

Address:_________________________________ Phone No.:_____________________________

City/State/Zip:____________________________ Fax No.:_______________________________

DAY 1:
Time Left Lab:_______ Time Arrived at Site:_______

DAY 2:
Time Left Lab:_____ Time Arrived at Site:_______

Time Left Site:_______ Time Arrived at Lab:_______ Time Left Site:_____ Time Arrived at Lab:_______

Project Name:_____________________________ Sample ID:____________________________

Sample Location/Description:____

Type of Sample: GRAB COMPOSITE If composite, MANUAL AUTOSAMPLER

If composite, sample type: FLOW or TIME If composite, sample time period:_________________

If composite, describe sample frequency (i.e., every 30 minut es or 3,000 gallons: ___________________

____

If composite, date/time started:______________ date/time ended:______________________
If autosampler used, list: MFR.:______________ Model:___________ Serial No.:__________

Sampler program information:____

____

Sampler decontamination procedure (before and after use:) ____________________________________
____

If grab, describe how sample was collected and with what equipment (include decon procedures):________

____
____

If grab: Date Collected:______________ Time Collected:___________________

Field Measurements (if applicable):

Temp.:_____________ pH:__________ Total Res. Chlorine:_______________ Free Avail. Chlorine:______________

Sample Condition Described: (i.e., color, physical state (sludge, oily, cloudy, clear, etc.), particulate matter (color, size, amount of solids, etc.)):

____

Field Technician's/Sampler's Signature:___________________________ Date:_______________

Table 6-1:
Sampling Capabilities

PARAMETER GROUP	SAMPLING SOURCE
Volatile and Extractable Organic Compounds	Groundwater, surface water, wastewater, effluents, stormwater runoff, soils, sediments, domestic waste water sludges
Metals	Groundwater, surface water, drinking water, wastewater effluents, stormwater runoff, soils, sediments, domestic wastewater sludges
Inorganic Anions (Inorganic anions and other non-metallic tests)	Groundwater, surface water, drinking water, wastewater effluents, stormwater runoff, soils, sediments, domestic wastewater sludges
Inorganics (BOD, COD, O&G, TOC, TRPH, Phenolics and Surfactants)	Groundwater, surface water, wastewater effluents, stormwater runoff, soils, sediments, domestic wastewater sludges
Physical Properties	Groundwater, surface water, drinking water, wastewater effluents, stormwater runoff, soils, sediments, domestic wastewater sludges
Microbiology	Groundwater, surface water, drinking water, wastewater effluents, stormwater runoff, soils, sediments, domestic wastewater sludges
Cyanide	Groundwater, surface water, wastewater effluents, stormwater runoff, soils, sediments, domestic wastewater sludges

Table 6-2:
Field Equipment used for the Sampling of Wastewater Influents and Effluents
INFLUENTS AND EFFLUENTS

EQUIPMENT	CONSTRUCTION	USE	PERMISSIBLE PARAMETERS	RESTRICTIONS PRECAUTIONS
Automatic Sampler	Pump: Dow Corning medical grade Silastic tubing or equivalent Sample Train: Teflon or Tygon, or equivalent Sample Containers: reusable glass or plastic sample containers	Sampling, Compositing	Demand, Nutrients, Inorganic Anions, Cyanide, Metals	None
Extension Pole Grab Sampler	Polyethylene Cup	Grab samples	All parameter groups, except VOC's	a
Misc. Equipment See Table 6-8	---	---	---	---

Key to Restrictions and Precautions
a. Intermediate vessels are not recommended for the collection of Oil and Grease.

Table 6-3:
Field Equipment used for the Sampling of Surface Water

EQUIPMENT	CONSTRUCTION	USE	PERMISSIBLE PARAMETERS	RESTRICTIONS PRECAUTIONS
Extension Pole Grab Sampler	Polyethylene	Grab samples	All parameter groups	a
Misc. Equipment See Table 6-8	---	---	---	---

Key to Restrictions and Precautions
a. Intermediate vessels are not recommended for the collection of Oil and Grease

Table 6-4:
Field Equipment used for the Sampling of Groundwater Monitoring Wells

EQUIPMENT	CONSTRUCTION	USE	PERMISSIBLE PARAMETERS	RESTRICTIONS PRECAUTIONS[1]
Bailers	SS, Teflon	Purging	All Parameter Groups	None
		Sampling	All Parameter Groups	None
	PVC, HDPE	Purging	All Parameter Groups	Not Recommended
		Sampling	All Parameter Groups	Not Recommended
Misc. Equipment See Table 6-8	---	---	---	---

N/A: Not applicable
SS: Stainless Steel
HDPE: High Density Polyethylene
PVC: Polyvinyl Chloride
VOC: Volatile Organic Compound

Footnotes:
1. Note: The use of non-inert (i.e., PVC, HDPE, etc.) is not recommended.

Table 6-5:
Field Equipment used for the Sampling of Sediments, Soils, Residuals, and Solid Waste

EQUIPMENT	CONSTRUCTION	USE	PERMISSIBLE PARAMETERS	RESTRICTIONS PRECAUTIONS[1]
Core Barrel (or liner)	SS, Teflon, Glass, Teflon coated, or Aluminum	Sampling	All parameter groups	a, b, c
	Polyethylene liner	Sampling	Demands, Nutrients	None
			Metals	b
Trowel, scoop, spoon or spatula	SS, Teflon, or Teflon coated	Sampling and Compositing	All parameter groups	VOC samples may not be taken from composite samples
	Polyethylene	Sampling and Compositing	Demands, Nutrients, Metals	None
Shovel, Hand Auger, Bucket Auger	SS	Sampling	All parameter groups	none
Shelby tube	SS	Sampling	All parameter groups	c
	Carbon steel	Sampling	All parameter groups	c,d; Samples for VOC and Metals must be taken from the interior of the core sample
EnCore™ Sampler, T-handle	Inert Materials	Sampling	All parameter groups	None
	SS	Sampling	All parameter groups	None
Split Spoon	SS or carbon steel w/Teflon insert	Sampling	All parameter groups	a,b

SS: Stainless Steel
VOC: Volatile Organic Compound
Footnotes
1. Key to Restrictions and Precautions listed below

Key to Restrictions and Precautions

a. If samples are sealed in the liner for transport to the laboratory, the sample for VOC analysis must be taken from the interior part.
b. Liners must be constructed of stainless steel or a suitable non-metallic material If a carbon-steel liner is used with the core barrel, the samples for metals shall be taken from the interior part of the core sample.
c. Aluminum foil, trays, or liners may be used only if aluminum is not an analyte of interest

Table 6-6: Field Equipment used for Sampling of Microbiological Specimans

EQUIPMENT	CONSTRUCTION	USE	PERMISSIBLE PARAMETERS	RESTRICTIONS PRECAUTIONS
Surface Grab	Taken by hand	Grab samples	Microbiologicals	None
Misc. equipment See Table 6-8	---	---	---	---

Table 6-7: Field Equipment used for the Sampling of Liquid Waste, Drums, and Tank Trucks

EQUIPMENT	CONSTRUCTION	USE	PERMISSIBLE PARAMETERS	RESTRICTIONS PRECAUTIONS[1]
Coliwasa	Glass, or SS	Sampling multi-phase liquids and slurries	All parameter groups	none
Capillary Tube	Glass	Sampling multi-phase liquids and slurries	All parameter groups	none
Extension Pole Grab Sampler	Polyethylene	Grab samples	All parameter groups	a
Bailers	SS, Teflon	Sampling	All parameter groups	none
Misc. Equipment See Table 6-8	---	---	---	---

SS: Stainless Steel
1. Key to Restrictions and Precautions listed below
Key to Restrictions and Precautions
a. If Intermediate vessels are not recommended for the collection of Oil and Grease or TRPH samples.

Table 6-8:
Miscellaneous Field Equipment used for all Sampling Events

EQUIPMENT	CONSTRUCTION	USE	PERMISSIBLE PARAMETERS	RESTRICTIONS PRECAUTIONS[1]
Decontamination Equipment and Supplies (if equipment is cleaned in the field)				
Basins, buckets or bowls used to hold wash water and various rinse waters	SS, HDPE, Glass	In-field equipment decontamination	All parameters	none
Brushes or other implements used to clean equipment	Non-inert handle w/nylon bristles	See above	All parameters	none
Detergent: Liquinox	N/A	See above	All Parameters	none
Protective wrapping: Aluminum foil Zip-Lock bags	Aluminum Plastic	Wrapping and Packaging of decontaminated equipment	All parameters	none
Analyte-free water containers	Glass	Transportation of organic-free water	All parameters	c
	HDPE	Transportation of DI water	All parameters	c
Supplies for field measurements				
Preservation Supplies				
Narrow range pH paper	N/A	Checking preservation	All parameters	Intermediate container used
Filtering Equipment				
Syringe	Polyethylene	Field filtering	Metals, OP	None
1.0 or .45 µm filters	Commercially prepared	Field filtering	Metals, OP	None
Sample Transportation Supplies				
Ice Chest	Polyethylene	Transportation of samples	All parameters	none
Ice	N/A	Cooling samples	All parameters	none
Sealing tape	Polyethylene	Sealing ice chests for shipment	All parameters	none
Shipping labels and forms	Paper	Shipping samples	All parameters	none
Sample labels	Paper	Labeling samples	All parameters	none
Bubble wrap	Polyethylene	Packaging	All parameters	none
Protective Clothing				
Gloves	Powder-free latex	Personal protection, sample contamination prevention	All parameters	d

EQUIPMENT	CONSTRUCTION	USE	PERMISSIBLE PARAMETERS	RESTRICTIONS PRECAUTIONS[1]
Protective Clothing (Con't)				
Coveralls	Cotton, Tyvek	Personal protection	All parameters	none
Respirators	Materials differ	Personal protection	All parameters	none
Documentation Supplies				
Logbooks, Field sheets	Paper	Documentation	All parameters	none
Pens, Markers	N/A	Documentation	All parameters	none
Chain of Custody	Paper	Documentation	All parameters	none
Camera	N/A	Documentation	All parameters	none
Calculator	N/A	Calculations	All parameters	none
Reference Materials				
CQAP	Paper	Reference	All parameters	none
Site Maps	Paper	Reference	All parameters	none
Calculator	N/A	Calculations	All parameters	none
Other Equipment				
Lanyards for Bailers	Monofilament Nylon	Bailer lanyard	All parameters	Disposable, one use only
Paper towels	Paper	Absorbing	All parameters	none
Protective sheeting	Polyethylene	Placement around well heads	All parameters	none
Drums	Metal, HDPE	Contain and dispose purge waters and wastes	All parameters	Must be properly labeled
Water level indicator tape	SS tip with polyethylene- coated cable	Water level determination	All parameters	Must be field-cleaned between each use
Field Test Instruments – See Table 9.1				

[1]Key to Restrictions and Precautions

a. Nitric acid should not be used on steel sampling equipment.

b. Analyte-free water should not be left in these containers for extended periods, especially HDPE. These containers should be filled for a single sampling event and then emptied at the end of the sampling day.

c. New, disposable gloves, un-powdered latex gloves are changed and discarded after every sampling point. Other type of gloves may be used as long as the construction materials do not contaminate the sample or if safety protocols require greater protection.

d. 0.45 μm filter used for Ortho-phosphorous and FDEP surface water dissolved metals. 1.0 μm high capacity cartridge filter used in line with pressurized bailer for FDEP groundwater dissolved metals samples.

Table 6-9:
Sample Preservation, Holding Times, Container/Lid Types, and Required Sample Volumes for Organics

Parameter	Container	Preservative	Minimum Volume	Maximum Holding Time
Volatile Orgainics	Water - 2 40 mL Glass Purge Vials	Water - 1:1 HCl to a pH > 2, no headspace, cool 4°C	80 mLs	14 days
	Solids - 4 oz widemouth glass jar with teflon closure	Solids – No headspace Cool 4°C	30 g	14 days
	Medium Level Soils – 5 g sample in purge vial with stirbar	5.0 mLs Methanol in purge vial.	Target of 5.0 g of sample	14 days
	Low Level Soils – 5 g sample in purge vial with stirbar	5.0 mLs sodium bisulfate in purge vial	Target of 5.0 g of sample	14 days
Semi-Volatile Organics	Water - 1 L Amber Glass Jar	Cool 4°C	1 L	7 days
	Solids - 4 oz widemouth glass jar with teflon closure	Cool 4°C	100 g	14 days
TCLP Extraction	Solids - 32 oz widemouth glass safety coated jar	Cool 4°C	300 g	Metals 6 mo. Organics 14 days
UST Volatiles	Water - 2 - 40 mL Glass Purge Vials	Water-1:1 HCl to a pH <2, no headspace, cool 4°C	80 mLs	14 days
	Solids - 4 oz widemouth glass jar with teflon closure	Solids – No headspace Cool 4°C	30 g	14 days
UST Semi-Volatiles	Water - 1 L Amber Glass Jar	Cool 4°C	1 L	7 days
	Solids - 4 oz widemouth glass jar with teflon closure	Cool 4°C	100 g	14 days
Pesticides/PCBs	Water - 1 L Amber Glass Jar	Cool 4°C	1 L	7 days
	Solids - 4 oz widemouth glass jar with teflon closure	Cool 4°C	100 g	7 days
PCBs	Water - 1 L Amber Glass Jar	Cool 4°C	1 L	7 days
	Solids - 4 oz widemouth glass jar with teflon closure	Cool 4°C	100 g	14 days
	Wipes	Cool 4°C	Wipe	14 days
	Oils - 15 mL glass vial	Cool 4°C	5 mL	NA
Alcohols	Water - 2 - 40 mL Glass Purge Vials	Cool 4°C	80 mLs	14 days
	Solids -4 oz widemouth glass jar with teflon closure	Cool 4°C	30 g	14 days
Polynuclear Aromatic Compounds (PNA/PAH)	Water - 1 L Amber Glass Jar	Cool 4°C	1 L	7 days
	Solids - 4 oz widemouth glass jar with teflon closure	Cool 4°C	100 g	14 days

TABLE 6-10:
Sample Preservation, Holding Times, Container/Lid Types, and Required Sample Volumes for Inorganics and Metals

Parameter	Container	Preservative	Minimum Volume	Maximum Holding Time
Acidity	1L high density polyethylene bottle	Cool 4°C	100 mL	14 days
Alkalinity	1L high density polyethylene bottle	Cool 4°C	100 mL	14 days
Ammonia	1L high density polyethylene bottle	Cool 4°C, H_2SO_4 pH<2	400 mL	28 days
Biochemical Oxygen Demand (BOD)	1L high density polyethylene bottle	Cool 4°C	1L	48 hours
Carbonaceous Biochemical Oxygen Demand (cBOD)	1L high density polyethylene bottle	Cool 4°C	1L	48 hours
Bromide	1L high density polyethylene bottle	Cool 4°C	100 mL	28 days
Chemical Oxygen Demand (COD)	1L high density polyethylene bottle	Cool 4°C, H_2SO_4 pH<2	100 mL	28 days
Chloride	1L high density polyethylene bottle	Cool 4°C	100 mL	28 days
Cyanide	1L high density polyethylene bottle	Cool 4°C, NaOH pH>12	500 mL	14 days
Fluoride	1L high density polyethylene bottle	Not Applicable	300 mL	28 days
Hardness	1L high density polyethylene bottle	H_2SO_4 pH<2	100 mL	180 days
pH	1L high density polyethylene bottle	Not Applicable	100 mL	Immediately
Kjeldahl & Organic Nitrogen	1L high density polyethylene bottle	Cool 4°C, H_2SO_4 pH<2	500 mL	28 days
Hexavalent Chromium	1L high density polyethylene bottle	Cool 4°C	100 mL	24 hours
Mercury	1L high density polyethylene bottle	Cool 4°C, HNO_3 pH<2	100 mL	28 days
Metals	1L high density polyethylene bottle	HNO_3 pH<2	200 mL	180 days
Nitrate	1L high density polyethylene bottle	Cool 4°C	100 mL	48 hours
Nitrate-Nitrite	1L high density polyethylene bottle	Cool 4°C, H_2SO_4 pH<2	100 mL	28 days
Nitrite	1L high density polyethylene bottle	Cool 4°C	100 mL	48 hours
Oil & Grease	1L amber glass	H_2SO_4 pH<2 Cool 4°C	1 L	28 days
Total Organic Carbon (TOC)	125 mL amber bottle	Cool 4°C, H_2SO_4 pH<2	125 mL	28 days
Total Organic Halogens (TOX)	500 mL amber bottle	Cool 4°C, H_2SO_4 pH<2	500 mL	28 days
Phenols	1L amber glass	Cool 4°C, H_2SO_4 pH<2	500 mL	28 days
Orthophosphorus	1L high density polyethylene bottle	Cool 4°C	100 mL	48 hours
Total Phosphorus	1L high density polyethylene bottle	Cool 4°C, H_2SO_4 pH<2	100 mL	28 days
Total Solids	1L high density polyethylene bottle	Cool 4°C	100 mL	7 days
Total Dissolved Solids	1L high denity polyethylene bottle	Cool 4°C	100 mL	7 days

TABLE 6-10 Con't:
Sample Preservation, Holding Times, Container/Lid Types, and Required Sample Volumes for Inorganics and Metals

Parameter	Container	Preservative	Minimum Volume	Maximum Holding Time
Total Suspended Solids	1L high density polyethylene bottle	Cool 4°C	1 L	7 days
Settleable Solids	1L high density polyethylene bottle	Cool 4°C	1000 mL	48 hours
Total Volatile Solids	1L high density polyethylene bottle	Cool 4°C	100 mL	7 days
Silica	1L high density polyethylene bottle	Cool 4°C	100 mL	28 days
Specific Conductance	1L high density polyethylene bottle	Cool 4°C	100 mL	28 days
Sulfate	1L high density polyethylene bottle	Cool 4°C	100 mL	28 days
Sulfide	1L high density polyethylene bottle	Cool 4°C, NaOH pH>9	500 mL	7 days
Sulfite	1L high density polyethylene bottle	Cool 4°C	100 mL	Immediately
Turbidity	1L high density polyethylene bottle	Cool 4°C	100 mL	48 hours
E. Coli and Total Coliform Bacteria – Drinking Water	120mL Sterile container	Recommended - Cool 4°C, Sodium Thiosulfate	100mL	30 hours from time of collection
Fecal Coliforms – Wastewater	120 mL, sterile	Cool 4°C	100mL	24 hours from time of collection

Section 7.0
Sample Custody and Handling

The sample management procedures used at TestAmerica Analytical Testing Corp – Cedar Falls, IA are designed to ensure that sample integrity is maintained and documented.

7.1 Procedure to Assess Capability to Perform Work

It is the primary responsibility of Project Coordinators and Operations Management to manage workload in the laboratory. Availability of capacity in the laboratory is contingent on both labor and instrumentation. Because these variables can change, TestAmerica Analytical Testing Corp-Cedar Falls, IA has developed mechanisms to pro-actively manage capacity. These mechanisms involve constant communication and utilization of our Laboratory Information Management System (LIMS). Outlined below are TestAmerica Analytical Testing Corp-Cedar Falls, IA procedures for managing workload:

All analytical work is checked into LIMS and is given a sample and job number. A personal responsibility list (PRL) has been developed in each analytical department (Conventionals, Metals, Volatiles, Semivolatiles, Sample Preparation). The PRL list includes the following information: number of samples checked into the laboratory by test, due date of the samples and hold date of the sample. It is the responsibility of the analysts to review the PRL and bring to the attention of the Operations Manager any scheduling problems. Alternatively, for areas in which there is a PRL generated that is not the responsibility of only one analyst, it is the responsibility of the Operation Managers to review the PRL daily with the analysts and bring any problems with scheduling forward to the operations meeting.

All rush work must be pre-approved by the operation manager or the analyst prior to acceptance by the laboratory. Once the samples are received, they are entered into the computer system as a rush sample, designated by a "R". This "R" appears on the laboratory queue sheets and scheduling reports. The login sheets also include a large red "RUSH" stamp notice. These actions ensure that all affected parties take appropriate steps to rush the turn around time of the sample.

The Operations Manager and Project Coordinator print a detailed status report, which provides detailed information on all jobs that are logged into the laboratory. This information includes the job due date and incomplete analyses on a per job basis. If needed, the Operations Manager and Project Coordinator conduct a daily scheduling meeting with analysts to review the detailed job list and department PRLs. Scheduling and instrument issues on a department by department basis are discussed and resolved. The Project Coordinator also presents any large quotation information to the analysts-so that new work capacity can be discussed. Departments with limited capacity or scheduling issues are noted and this information is delivered to Customer Service from the Project Coordinator so clients can be notified.

Operations Management is responsible for notifying Project Coordinators of any operational issues that may cause backlog problems. Project Coordinators are responsible for informing customer service and clients of operational issues leading to backlog and informing new clients of the laboratory's available capacity.

7.2 Field Sample Custody

The collection personnel must first consider the analyses to be performed so that proper sample containers and shipping containers are assembled and the proper preservatives are added to containers. All records required for documentation of field collection, including the Chain of Custody (COC) (Figure 7-1), pertinent data on sample labels (Figure 7-2), and the Field Services Form (See figure 6-2 in Section 6) must be completed by the field personnel, if the field sampling is performed by TestAmerica Field Services.

The purpose of the COC is to supply a detailed record of the sample description, collection information, and any transfer of custody from sample collection through sample receipt into the laboratory. The sample collector is responsible for the care and custody of the samples until properly dispatched to the receiving laboratory or turned over to the sample custodian or designee. The sample collector must assure that each container is in his/her physical possession or in his/her view at all times, or stored in such a place and manner to preclude tampering. Samples should be delivered to the laboratory as soon as possible.

NOTE: Independent couriers are not required to sign the COC form. The COC is usually kept in the sealed sample cooler.

7.3 Sample Receipt Protocols

Sample acceptance, receipt, tracking and storage procedures are fully detailed in TestAmerica Analytical Testing Corp-Cedar Falls, IA sample management standard operating procedures. These procedures are summarized in the following sections.

7.3.1 The integrity of each sample must be determined by comparing sample labels or tags with the COC and by visual checks of the container for possible damage. Any problems or deviations are recorded on the Sample Receipt and Temperature Log Form (Figure 7-4). Inspection of samples include:

7.3.1.1 Complete documentation to include sample identification, date, and time of collection, collector's name, preservation type, sample type and any additional comments concerning the samples.

7.3.1.2 Complete sample labels to include unique identification in indelible ink.

7.3.1.3 Use of appropriate sample containers.

7.3.1.4 Adherence to holding times as specified in the test method and/or summarized in Section 6.

7.3.1.5 Adequate sample volume for required analyses.

7.3.1.6 Test(s) to be performed on the sample(s).

7.3.1.7 Date and time the sample was taken.

7.3.1.8 Damage or signs of contamination to sample container. Volatile vials are also inspected for headspace.

7.3.1.9 Temperature of the samples that require thermal preservation is measured and recorded upon sample receipt. Samples shall be deemed acceptable if arrival temperature is either within ± 2 ° C of the required temperature or the method specific range. For samples with a specified temperature of 4 ° C, samples ranging from just above freezing (>0 °C) to 6 ° C shall be acceptable. Samples that are hand delivered within 24 hours after collection may not be at the required to meet thermal preservation if there is evidence of a chilling process. The temperature of the samples in the cooler is determined one of three ways.

a) If a temperature blank (a 125mL plastic bottle, see Figure 7-3 for a temperature blank label) or a plastic container is included with the samples, the temperature is recorded by measuring the temperature of the service of the container with the IR gun.

b) If there is no temperature blank or plastic container included in the cooler, then the temperature may be taken from a sample container with the IR thermometer by removing the container lid and measuring the temperature of the liquid directly.

c) If the sample cooler contains purge vials only, then the temperature is measured by inserting a probe thermometer directly into a purge vial. The purge vial integrity is compromised and the vial should not be analyzed.

The temperature of the shipping container is recorded on the Sample Receipt and Temperature Log Form (Figure7-4) and is attached to the project information.

7.3.1.10 Sample preservation is checked as specified in the test method. The pH of a preserved sample for metals is checked after login process is completed. The results are recorded in the metals prep logbook.

7.3.1.11 The pH of purge vials for volatiles analysis are checked after the analysis is completed and is recorded in the volatiles pH logbook. The pH for Ammonia, COD, Cyanide, Hardness, Kjeldhahl/Organic Nitrogen, Nitrate/Nitrite, Oil & Grease, Phenols, TOX, TOC, and Total Phosphorus are checked by the analyst at the time of analysis and recorded in the data logbook for that analysis.

7.3.2 Samples received after normal working hours are received by the second shift supervisor or designated personnel The second shift supervisor or designated personnel will sign the COC to document sample receipt and record temperature of the shipping container (Section 7.3.1.9). Procedures listed in 7.3 are performed prior to sample log-in (Section 7.4)

7.3.2 Any deviations from the checks described in section 7.3.1 that question the suitability of the sample for analysis, or incomplete documentation as to the tests required are recorded on Sample Receipt and Temperature Log Form (Figure7-4) and Sample Non-Conformance Form

(Figure 7-5), if applicable. The deviations will be resolved by consultation with the client. If the sample acceptance criteria are not met, the laboratory shall either:

7.3.2.1 Retain all correspondence and/or records of communications with the client regarding the disposition of rejected samples, or

7.3.2.2 Fully document any correspondence with the client to proceed with sample analysis that does not meet sample acceptance criteria.

7.4 Sample Log-in and Laboratory Tracking

All samples that are received by TestAmerica Analytical Testing Corp – Cedar Falls, IA are logged into the Laboratory Information Management System (LIMS) to allow the laboratory to track and evaluate sample progress. LABSYS assigns a job identification number to the project and a sample identification number. A sample may be composed of more than one bottle since different preservatives may be required to perform all analyses requested. The LIMS will generate a sample label that is attached to each bottle of the sample. If there is more than one bottle per sample, the LIMS will generate a unique label for each bottle, with the same sample number except with a number extension included to identify each individual sample bottle (12345-1, 12345-2, 12345-3, etc.).

The login person verifies that the client information on the bottle matches the COC. The sample(s) are then logged in according to the instructions provided by the client on the COC.

7.4.1 The login person logs in each sample contained in the job recording the following information:

7.4.1.1 Client/Project Name, Address, Phone, Fax, Report to information, invoice to information.

7.4.1.2 Date Received, Date Taken, Time Received, and Time Taken

7.4.1.3 Job Description, Sample Description, Job location

7.4.1.4 Matrix of the Sample, Special Sample remarks

7.4.1.5 Reporting requirements (QC, Report Format, Invoicing Format)

7.4.1.6 Turn-around-time requirements

7.4.1.7 Parameters, methods, reporting limits

7.4.2 After the job is completely logged in, the LIMS prints a log sheet, order confirmation sheet and bottle labels. Durable bottle labels are then applied to the sample bottles.

7.4.3 The log sheet, order confirmation, COC, Sample Receipt and Temperature Log Form, sample disposition form and all corresponding sample information is matched with the samples. The COC and Sample Receipt and Temperature Log Form are scanned into our server for internet client access.

7.4.4 The login person at the end of each business day shall print the daily log which chronologically records the following login information:

7.4.4.1 Date of laboratory receipt of samples and date of log-in of the samples

7.4.4.2 Unique laboratory identification code

7.4.4.3 Sample description as supplied by the sample submitter

7.4.4.4 Client name and account number

7.4.4.5 Sample results due date

7.4.5 All projects that are logged in undergo the following review by the project coordinators / project managers shortly after log-in:

7.4.5.1 Parameter subcontract review

7.4.5.2 Appropriate methods and analysis selected

7.4.5.3 Short hold time parameters handled correctly

7.4.5.4 Appropriate reporting limits

7.4.5.5 Appropriate turn-around-time (TAT)

7.4.5.6 Adequate sample volumes collected

7.4.5.7 Sample disposition form review, was client contacted, was issue resolved

7.4.5.8 Clerical and typographical errors

7.4.5.9 Order confirmation reviewed for correct pricing

7.4.5.10 Special QC requirements

7.4.5.11 Special sample handling requirements

7.4.6 If there are problems with the login of the job the Project Manager / Project Coordinator is responsible for resolving the problem. Once the problem is resolved the Project Manager / Project Coordinator documents the action taken on the Sample Receipt and Temperature Log form and dates and initials it.

7.5 Storage Conditions

The primary considerations for sample storage are temperature, holding times, contamination and security.

Section 6 (Table 6-10 and 6-11) summarize the temperature and holding time protocols for various analyses. Samples, sample fractions, extracts, leachates or other sample preparation products that require thermal preservation shall be kept at ± 2° C of the test method requirements or other specified temperature range.

All samples distributed into the lab are stored separately from standards and reagents used for analyses to prevent any contamination. Samples are also stored away from food and other potentially contaminating sources. Samples may not be stored in the refrigerator compartment of a unit that has standards stored in the freezer compartment or vice versa.

Access to the laboratory is controlled such that sample storage need not be locked at all times. Samples are accessible to TestAmerica Analytical Testing Corp – Cedar Falls, IA personnel only. Visitors to the laboratory are prohibited from entering the refrigerator and laboratory areas unless accompanied by an employee of TestAmerica Analytical Testing Corp. Samples are returned to the appropriate refrigerator after sufficient sample has been obtained to complete the analysis.

7.6 Sample Disposal

Several possibilities for sample disposal exist: the sample may be consumed completely during analysis, the sample may be returned to the customer or location of sampling for disposal, or the sample may be stored after analysis (samples are normally maintained no longer than 6 weeks from receipt unless otherwise requested).

The TestAmerica Analytical Testing Corp-Cedar Falls, IA standard operating procedure for sample disposal describes the details of all disposal procedures (CF10-01).

7.7 LIMS Security

The Laboratory Information Management System (LIMS) was developed by National Environmental Testing, Inc., and was acquired by Test America. The LIMS is based upon proprietary database software, written in Informix. The operating system is SCO UNIX Open Server S. Test America internally controls all modifications, user access, and security. The LIMS is referred to as LABSYS within Test America. LABSYS uses a password security system. All personnel have a log-in name, which restricts the access to system files based upon the level of security they are granted. All personnel are given a unique password that must be entered each time the system is accessed.

7.7.1 LABSYS offers 21 different areas of permission. Each area is used to restrict access to a different portion of the LIMS. Some typical "permissions" are as follows (the ability to view customer data and job or sample information is not password protected, that is, anyone with a password to the system is able to view that information):

7.7.1.1 Analyst – Data entry, QA data entry, and the correction of this data.

7.7.1.2 Sample Custodian/Login – Logging in of samples; client information modification; invoicing; quote creation and modification.

7.7.1.3 Project Management – Logging in of samples; client information modification; quote creation and modification; report generation

7.7.1.4 Customer Service – Logging in of samples; client information modification; quote creation and modification.

7.7.1.5 Operation Managers – Data entry, QA data entry and the correction of this data; logging in of samples; quote creation and modification; report generation; approval of analytical data; modification of default reporting limits and test methods.

7.7.1.1 QA Officer/Systems Administrator – QA Officer / Systems Administrator – Data entry, QA data entry, and the correction of this data; logging in of samples; quote creation and modification; client information modification; report generation; approval of analytical data; creation of test codes for the LIMS; LIMS modification, such as report formats, control limit updates, data archival, password clearance, client access clearance.

7.7.1.2 Division Manager – Data entry, QA data entry, and the correction of this data; logging in of samples; quote creation and modification; invoicing; client information modification; report generation; approval of analytical data; creation of test codes for the LIMS; LIMS modification, such as report formats, control limit updates, data archival, password clearance, client access clearance.

7.7.3 This password records each computer operation with the person initiating that operation, e.g., data entry or data modification. An explanation may accompany the data change with initials before the system will implement the data change.

7.8 Computer Maintenance

The LIMS database is maintained by the TestAmerica Analytical Testing Corp Information Technology Group. Technical support for the database system is provided by Decision System Plus, Inc. SCO and hardware support is provided by IBM. The entire LIMS is backed up nightly (11:00pm M-F) and archived with limited access.

7.9 Sub-contracting

A sub-contract laboratory is defined by TestAmerica Analytical Testing Corp as a laboratory external to the TestAmerica Analytical Testing Corp network. However, there are some situations where a network lab must be defined as a sub-contract laboratory and requires client or agency approval prior to use on a project. These requirements are defined in writing at the start of the project. In these cases, work will only be sub-contracted to an approved laboratory (internal or external) and the client will be notified as requested.

The Operation Managers are responsible for identifying and initiating pre-qualification of the subcontract laboratory by completing the Subcontracting Laboratory Approval Form (Figure 7-6).

7.9.1 Qualified sub-contracting laboratories are requested to provide the following:

7.9.1.1 Copy of the Quality Assurance Manual

7.9.1.2 Copies of relevant performance evaluation sample results

7.9.1.3 Copy of necessary certifications

7.9.1.4 Example of a final report

7.9.1.5 Price list or quotation

7.9.2 These procedures do not apply to laboratories where the clients have previously qualified the sub-contractor laboratory. The client will assume responsibility for the quality of the data generated from use of the sub-contractor that TestAmerica Analytical Testing Corp has not qualified.

7.9.3 The Division Manager may waive this process temporarily to meet emergency program needs. In the event this provision is utilized, the Corporate Director of Quality Assurance will be informed. The Quality Assurance Officer, Operations Manager or Project Coordinator will immediately request full documentation and qualify the sub-contractor under the provisions above within 30 calendar days.

TestAmerica
ANALYTICAL TESTING CORPORATION

Cedar Falls Division
704 Enterprise Drive
Cedar Falls, IA 50613

Phone 319-277-2401 or 800-750-2401
Fax 319-277-2425

To assist us in using the proper analytical methods, is this work being conducted for regulatory purposes?
Compliance Monitoring ____________

Client Name ____________ Client #: ____________

Address: ____________

City/State/Zip Code: ____________

Project Manager: ____________

Telephone Number: ____________ Fax: ____________

Sampler Name: (Print Name) ____________

Sampler Signature: ____________

Email Address: ____________

Project Name: ____________

Project #: ____________

Site/Location ID: ____________ State: ____________

Report To: ____________

Invoice To: ____________

Quote #: ____________ PO#: ____________

TAT
___ Standard
___ Rush (surcharges may apply)

Date Needed: ____________

Fax Results: Y N

Email Results: Y N

QC Deliverables
___ None
___ Level 2
(Batch QC)
___ Level 3
___ Level 4
Other: ________

					Matrix	Preservation & # of Containers							Analyze For:										
SAMPLE ID	Date Sampled	Time Sampled	G = Grab, C = Composite	Field Filtered	SL - Sludge DW - Drinking Water GW - Groundwater S - Soil/Solid WW - Wastewater Specify Other	HNO_3	HCl	NaOH	H_2SO_4	Methanol	None	Other (Specify)											REMARKS

Special Instructions:

LABORATORY COMMENTS:

Relinquished By:	Date:	Time:	Received By:	Date:	Time:
Relinquished By:	Date:	Time:	Received By:	Date:	Time:
Relinquished By:	Date:	Time:	Received By:	Date:	Time:

Page ______ of ______

Figure 7.1: Chain of Custody Form (Front).

Figure 7-1 Chain of Custody Form (Back)

Sampling containers provided to you by TestAmerica may contain small amounts of required preservative. The preservatives are concentrated and could potentially cause harm to any point of contact. Please do not rinse any of these prior to use.

Plastic or Glass Container

- Fill plastic & glass containers to the neck of the bottle.
- Do not over fill your container because there is risk in diluting your preservative.
- Do not under fill your container because the laboratory requires a specific volume to adequately perform your analyses.

Purge Vials

- Fill the purge vial completely full (reverse meniscus). Screw on the cap and check the vial for air bubbles. A properly filled vial will contain no air bubbles.

Soil Jars

- Volatile Analysis: A separate 4 oz. jar should be packed full with as little headspace to prevent volatilization of the analytes of interest. (See special instructions for 5035 sampling technique.)
- Other Analysis: The jar should be packed full, the laboratory requires a specific amount and it is always good practice to provide the laboratory with extra sample in case re-analysis is required.

Chain of Custody (COC)

Please fill out the COC completely and accurately. The laboratory will use this form to determine what tests need to be performed. Incomplete COC will slow down this process and slow the analytical process. Use a blue or black ball point pen and neatly record the necessary information in the spaces provided.

- Analyze For: (Fill in the different types of analysis needed for each sample description.) Match up the Sample ID with the corresponding Analyze For: block, and mark the corresponding square.
- Indicate if analysis is Standard TAT or RUSH
    - RUSH – indicate the date needed in space provided
- Indicate if you want the results faxed/emailed (PDF Format)
- Indicate what QC deliverables you need with your report.
- NOTES: (Include any special instructions, analytical methods, etc.)
- Complete the Relinquished by: Date, Time, and Shipped Via: blocks.
- Keep the pink copy for your records.

Cooler Packing

- Pack samples in sufficient ice to ensure proper preservation. (> 0 °C to 6 °C)
- Pack samples tightly and securely to prevent breakage
- Make sure COC is filled out, signed, and enclosed in a zip top bag inside the cooler.
- Apply Custody seals
- Tape cooler closed
- Label clearly
- Ship using a method that enables the samples to be received by the laboratory within the allotted holding time and at the required temperature.

If you have any questions or concerns with this document please contact the laboratory.

Figure 7-2: Field Sample Label

TestAmerica
ANALYTICAL TESTING CORPORATION
CLIENT
DATE TIME
SAMPLE ID
BOTTLE LOT #
NO TREATMENT

TestAmerica
ANALYTICAL TESTING CORPORATION
CLIENT
DATE TIME
SAMPLE ID
BOTTLE LOT #
CAUTION: Contains chemical preservative, may cause burns. Flush contact area with large quantities of water.
H_2SO_4 PRESERVED

TestAmerica
INCORPORATED
CLIENT
DATE TIME
SAMPLE ID.
BOTTLE LOT #
CAUTION: Contains chemical preservative, may cause burns. Flush contact area with large quantities of water.
NaOH PRESERVED

TestAmerica
INCORPORATED
CLIENT
DATE TIME
SAMPLE ID.
BOTTLE LOT #
CAUTION: Contains chemical preservative, may cause burns. Flush contact area with large quantities of water.
HNO_3 PRESERVED

Figure 7-3: Temperature Blank Label

TEMPERATURE BLANK

Used to determine temperature of the samples upon receipt by TestAmerica

Contains Tap Water
Do not freeze.
Please return in the cooler with samples.

Figure 7-4: Sample Receipt and Temperature Log Form.

TestAmerica 704 Enterprise Drive • Cedar Falls, IA 50613 • 800-750-2401 • 319-277-2425 Fax

ANALYTICAL TESTING CORPORATION

Sample Receipt and Temperature Log Form

Client: ______________________ Project: ________________

City: ________________

Date: __________ Receiver's Initials __________ Time (Delivered): ________

Temperature Record

Cooler ID# (If Applicable)

____

________ **° C / On Ice**

☐ Temp Blank

☐ Temperature out of compliance

Custody seals present?

☐ Yes

Custody seals intact?

☐ Yes ☐ No

☐ Non-Conformance report started

Thermometer:

☐ IR – 905085 "A"

☐ IR – 809065 "B"

☐ CF07-03-T2

☐ 22126775

Courier:

☐ Airborne ☐ Speedy

☐ UPS ☐ TA Courier

☐ Velocity ☐ TA Field Svs

☐ FedEx ☐ Client

☐ DHL

☐ US Postal ☐ Other

Exceptions Noted

☐ Sample(s) not received in a cooler.

☐ Samples(s) received same day of sampling.

☐ Evidence of a chilling process

☐ Temperature not taken:

____

Log-In by:

CW MF EM

OT__________

***Refer to SOP CF01-01 for Temperature Criteria**

C:\Documents and Settings\mmcgowan\Desktop\QA Files\QA Forms & Log Book pgs\Cooler Receipt rev8.doc

Figure 7-5: Sample Non-Conformance Form

Sample Non-Conformance Form

Date: ____________

Dear Client: ______________________________

Your samples were received at the TestAmerica – Cedar Falls lab today. The following discrepancies were found.

☐ The sample(s) was received outside of the required temperature range of 4 ± 2°C. Please see attached temperature sheet.

☐ The sample(s) exceeded its holding time upon receipt at the laboratory. Please refer to attached order confirmation.

☐ The sample information on the Chain of Custody does not match the sample information on the sample container. Please refer to attached order confirmation.

☐ A sample container was broken in transit. Analysis will proceed with existing sample. Reporting limits may be elevated. Contact lab representative with questions.

☐ Insufficient sample received to properly analyze. Reporting limits may be elevated. Please refer to attached order confirmation. Contact lab representative with questions.

☐ Other –

Analysis on the above discrepancies will proceed. **If you would like the analysis stopped or to clarify/respond to the above discrepancy please contact the person below via fax (319-277-8115) or phone (800-750-2401) as soon as you receive this notice.** If analysis proceeds you will be responsible for payment and the final report may be flagged as to the above discrepancy.

We appreciate your quick attention to this matter.

Melene Facciani Shawn Hayes Edna Muehling

Cheryl Wilson Linda Cmelik

Derrick Klinkenberg Kristin Clay

Figure 7-6 Sub-Contracting Laboratory Approval

TestAmerica
ANALYTICAL TESTING CORPORATION
704 Enterprise Drive • Cedar Falls, IA 50613 • 319-277-2401 • Fax 319-277-2425 • 800-750-2401

SUBCONTRACTING LABORATORY APPROVAL

Date: ____________

Laboratory: ____________

Address: ____________

____

Contact: ____________

Phone: ____________ Fax ____________

Requested Item	Date Received	Reviewed/ Accepted	Date
QA Manual			
Copy of State Certification[1]			
Recent State Audit with Corrective Action Response (NELAC, A2LA, or State Audit)			
Most Recent 2 Sets of Proficiency Sample Reports with Corrective Action Response[1]			
Summary List of Technical Staff and Qualifications			
SOPs for Methods to Be Loadshifted[2]			
Insurance Certificate			
Sample Report			

1 - Required when emergency procedures are implemented.
2 - Some labs may not submit copies due to internal policies. In these cases, a copy of the first page and signature page of the SOP is acceptable.

On Site Audit Planned: YES NO If yes, Date Completed: ____________

Comments:

Intend as a NELAC Subcontract Laboratory: YES NO

Lab Acceptable for Sub-Work: YES NO

QA Officer: ____________ Date: ____________

Division Manager: ____________ Date: ____________

Section 8.0
Analytical Procedures

8.1 Methods

8.1.1 Method Sources

Methods used are those currently accepted and approved by the U. S. EPA, NIOSH, and the state or territory from which the samples were collected. Reference manuals include:

8.1.1.1 Methods for Chemical Analysis of Water and Wastes, EPA 600/4-79-020,
8.1.1.2 Methods for the Determination of Metals in Environmental Samples, EPA/600/4-91/010, 1991
8.1.1.3 Standard Methods for the Examination of Water and Wastewater, 18th, 19th, or 20th Edition
8.1.1.4 Federal Register, 40 CFR Parts 136, 141, and 260.11,
8.1.1.5 Test Methods for Evaluating Solid Waste, Physical Chemical Methods, EPA SW-846,
8.1.1.6 NIOSH Manual of Analytical Methods,
8.1.1.7 Annual Book of ASTM Standards, Volume 11.01, Water (I),1996
8.1.1.8 OA-1 Method for Determination of Volatile Petroleum Hydrocarbons (Gasoline). Revision 7/23/93, University Hygienic Laboratory, Iowa City, IA
8.1.1.9 OA-2 Extractable Petroleum Products and Related Low Volatility Organic Compounds. Revision 7/27/93, University Hygienic Laboratory, Iowa City, IA
8.1.1.10 and selected analytical methods approved and cited by U. S. EPA.

Specific analytical procedures used by TestAmerica Analytical Testing Corp - Cedar Falls, IA are listed in Section 5 (Quality Assurance Objectives).

8.1.2 Standard Operating Procedures

TestAmerica Analytical Testing Corp - Cedar Falls, IA has developed Standard Operating Procedures (SOPs) for all analytical procedures and laboratory operations; these are specifically adapted to our laboratory. All SOPs are controlled in the laboratory: numbered sequentially, approved and signed by the Laboratory Director, Operations Manager(s), and Quality Assurance Officer, dated with an effective date, replaced in controlled manuals or placed in a read only format on the network, and archived when updated. Procedures for preparation, review, revision and control are incorporated by reference to Corporate SOPs: CP01-01 (Writing a Standard Operating Procedure (SOP)) and CP01-02 (Distribution and Control of Standard Operating Procedures and the QA Manual). All SOPs must be reviewed at least annually. All SOPs are accessible to each employee.

Each method SOP must contain a minimum of the following: identification of the test method; applicable matrix or matrices; method detection limit (procedure); scope and application, including components to be analyzed; summary of the test method; definitions; interferences; safety; equipment and supplies; reagents and standards; sample collection, preservation, shipment and storage; quality control; calibration and standardization; procedure; calculations; method performance; pollution prevention; data assessment and acceptance criteria for quality control measures; corrective actions for out-of-control or unacceptable data; waste management; references; and any tables, diagrams, flowcharts and validation data.

A general SOP must contain scope/application, definitions, safety issues, procedure, documentation, contingencies, attachments, and references.

> Note: Regarding NELAC standards:
> If more stringent standards or requirements are included in a mandated test method or by regulation, the laboratory shall demonstrate that such requirements are met. If it is not clear which requirements are more stringent, the standard from the method or regulation is to be followed.

8.1.3 Requirements for Methods Start-up

Before the laboratory may institute a new method (i.e., new to TestAmerica Analytical Testing Corp - Cedar Falls, IA) and begin reporting results, it must write an SOP, demonstrate satisfactory performance, and conduct a method detection limit study. There may be other requirements as stated within the published method or regulations (i.e., retention time window study, IDL). The method may be a recognized and published method or it may be a performance-based method. Procedures for start-up of a performance based method are incorporated by reference to the NELAC website "Quality Systems Guidance" documents.

Note: In some instances a situation may arise where a client requests that an unusual analyte be reported using a method where this analyte is not normally reported. If the analyte is being reported for regulatory purposes, the method must meet all procedures outlined within this Quality Assurance Manual (SOP, MDL, and Demonstration of Capability). If the client states that the information is not for legal or regulatory purposes, the result may be reported as long as the following criteria are met: 1) the instrument is calibrated for the analyte to be reported using the criteria for the method and ICV/CCV criteria are met (unless an ICV/CCV is not required by the method); 2) the reporting limit is set at or above the first standard of the curve for the analyte; 3) the client request is documented and the lab informs the client of its procedure for working with unusual compounds. The final report may be footnoted: "Reporting Limit based on the low standard of the calibration curve. This Lab is not NELAC Approved". If the compound requested is obscure, meaning that a reference standard is not available, a library search of the data system can be used to generate estimated qualitative results. The laboratory will report these result with appropriate data qualified

8.1.3.1 Demonstration of Capability

A Demonstration of Capability (DOC) must be made prior to using any test method to report results, and at any time there is a significant change in instrument type, personnel or test method.

In general, this demonstration does not test the performance of the method in real world samples, but in the applicable and available clean matrix, e.g., water, solids and air. However, actual sample spike results may be used to meet this standard, i.e., at least four consecutive matrix spikes within the last 12 months. In addition, for analytes that do not lend themselves to spiking, e.g., TSS, the demonstration of capability may be performed using quality control samples.

a) The spiking standard used must be prepared independently from those used in instrument calibration.
b) The analyte(s) shall be diluted in a volume of clean matrix sufficient to prepare four aliquots at the concentration specified by a method or if unspecified to a concentration approximately 10-20 times the method stated or laboratory calculated method detection limit.
c) At least four aliquots shall be prepared and analyzed according to the test method either concurrently or over a period of days.
d) Using all of the results, calculate the mean recovery in the appropriate reporting units and the standard deviations for each parameter of interest.
e) When it is not possible to determine mean and standard deviations, such as for presence, absence and logarithmic values, the laboratory will assess performance against criteria described in the Method SOP.
f) Compare the information obtained above to the corresponding acceptance criteria for precision and accuracy in the test method (if applicable) or in laboratory generated acceptance criteria (LCS or interim criteria) if there is no mandatory criteria established. If any one of the parameters do not meet the acceptance criteria, the performance is unacceptable for that parameter.
g) When one or more of the tested parameters fail at least one of the acceptance criteria, the analyst must proceed according to 1 or 2:.
    1. Locate and correct the source of the problem and repeat the test for all parameters of interest beginning with c) above.
    2. Beginning with c) above, repeat the test for all parameters that failed to meet criteria. Repeated failure, however, will confirm a general problem with the measurement system. If this occurs, locate and correct the source of the problem and repeat the test for all compounds of interest beginning with c) above.
h) A certification statement (see Figure 8-1 – Back Page) shall be used to document the completion of each demonstration of capability. A copy of the certification is archived in the analyst's training folder.
i) Methods on line prior to the effective date of this Section shall be updated to the procedures outlined above as new analysts perform their demonstration of capability. A copy of the new record will replace that which was used for documentation in the past. At a minimum the precision and accuracy of four mid-level laboratory control samples must have been compared to the laboratory's quality control acceptance limits.

When it is necessary to perform a DOC and a performance evaluation sample or Precision and Accuracy Study is not available the following procedures should be used

1. The lab analyst performs an analysis of a client sample and the result must agree within 20 % of the result produced by an experienced analyst.

2. When one or more of the tested parameters fail at least one of the acceptance criteria, the analyst must locate and correct the source of the problem and repeat the test for all parameters of interest beginning with 1.) above.

8.1.4 Analyst Training

TestAmerica Analytical Testing Corp - Cedar Falls, IA recruits, trains, and maintains an analytical staff with the education and technical knowledge necessary to perform appropriate analytical methods. The training program consists of defined job descriptions and evidence of an analyst's experience and performance. An experienced analyst or the supervisor trains a new analyst and documents the topics covered during the training (Figure 8-2). Prior to the completion of an analyst's demonstration of capabilities, all work must be reviewed and initialed by the trainer. All analysts are required to meet safety-training requirements specified in the safety manual. Employee training files contain the following information:

8.1.4.1 A completed Personnel Qualifications form or resume (see Figure 8-3)

8.1.4.2 A statement that he/she has read and understood the latest version of pertinent SOPs.

8.1.4.3 A statement that he/she has read and understood the latest version of the Quality Assurance Manual.

8.1.4.4 An annual signing of TestAmerica Analytical Testing Corp Quality Ethics Policy (Appendix 1). This policy outlines ethical and legal responsibilities and discusses penalties for improper, unethical or illegal action.

8.1.4.5 A Demonstration of Capabilities for all methods performed – both initial (see Figure 8-1) and continued proof of proficiency. Analysts hired prior to the effective date of this section may summarize their training on the form provided in Figure 8-4. Proof of continued proficiency must be documented by following one of the procedures listed below on an annual basis:

a) Acceptable performance of a blind sample (single blind to the analyst)

b) Another demonstration of capability.

c) Successful analysis of a blind performance sample on a similar test method using the same technology (e.g., GC/MS volatiles by purge and trap for 524.2, 624 or 5030/8260) would only require documentation for one of the test methods (see Figure 8-1)

d) At least four consecutive laboratory control samples with acceptable levels of precision and accuracy;

e) If a-d can not be performed, analysis of authentic samples that have been analyzed by another trained analyst with statistically indistinguishable results.

f) Acceptance criterion is established by method control limits listed in section 5.0 of this manual or by blind sample provider.

8.1.4.6 As stated in the "Manual for the Certification of Laboratories Analyzing Drinking Water, Fourth Edition" (EPA 815-B-97-001, Section 7.2.8), performance of drinking water analysis also requires the following additional training and documentation before an analyst is allowed to independently produce data. Prior to the completion of these items, all work must be reviewed and initialed by the trainer. The following must be available:

a) At least four consecutive laboratory control samples with acceptable levels of precision and accuracy

b) Initially, a Method Detection Limit (MDL) study for each analyte of interest.

c) Continuing, Demonstrate acceptable results for method detection by analysis of Reporting Limit Verification Standard (Section 11.1.25)

d) Satisfactory analysis of an unknown sample.

8.1.4.7 Documentation from training courses or workshops relevant to the employee's position. Documentation might include a copy of the agenda and any certificate received.

8.1.4.8 The Quality Assurance Department maintains a training summary that tracks which analysts have fulfilled the training requirements listed above for each method. This tracking is performed as part of the Internal Audit program (Section 14 – Performance and System Audits).

8.2 Laboratory Operations

8.2.2 Glassware

8.2.1.1 Glassware Specifications

All volumetric glassware must be Class A. Pyrex glass should be used where possible. For safety purposes, thick-wall glassware should be used where available.

8.2.1.2 Glassware Cleaning

The proper technique for cleaning glassware depends upon the intended use of the glassware being cleaned. The goal is to remove all substances from the glassware that might interfere with the analysis. Water-soluble substances can be removed with tap water followed with multiple rinses with laboratory-grade water. In some instances, detergent may be required. Detergent washings should be followed by three rinses with analyte-free water. Specific guidelines can be found in Table 8-1.

8.2.2.1 Glassware Storage

Once cleaned, glassware is capped, inverted or covered for storage in a designated cabinet, away from bulk chemicals or reagents.

8.2.2 Reagents/Standards

8.2.2.1 Purchase

The nature of the analytical laboratory demands that all material used in any of the procedures is of a known quality. The wide variety of materials and reagents available makes it advisable to specify the name, brand, and grade of materials to be used in any determination. This information is contained in the method SOP. The analyst should complete the Material Request Sheet (Figure 8-5) when requesting reagents or standards. The analyst must provide the master item number, from the approved master item list, item description, package size, catalogue page number, and the quantity needed. It is the responsibility of the purchasing manager to place the order and receive the shipment. It is the responsibility of the analyst who ordered the materials to date the material when received.

Once the ordered reagents or materials are received, the analyst compares the information on the label or packaging to ensure that the purchase meets the quality level specified in the SOP.

Material Safety Data Sheets are kept in the Library/Conference room. Anyone may review these for relevant information on the safe handling and emergency precautions of on-site chemicals.

8.2.2.2 Specifications

a) There are many different grades of analytical reagents available to the analyst. All methods in use in the laboratory specify the grade of reagent that must be used in the procedure. If the quality of the reagent is not specified, it may be assumed that it is not significant in that procedure and, therefore, any grade reagent may be used. It is the responsibility of the analyst to check the procedure carefully for the suitability of grade of reagent.
b) Chemicals must not be used past the manufacturer's expiration date and must not be used past the expiration time noted in a method SOP. If dates are not provided, the laboratory may contact the manufacturer to determine an expiration date.
c) The laboratory assumes a 5 yr expiration date on inorganic dry chemicals unless noted otherwise by the manufacturer or by the reference source method. Expiration dates can be extended if the reagent compared to an independent source in performing the method and the performance of the reagent is found to be satisfactory.
d) Records of manufacturer's certification and traceability statements are maintained in files or binders in each laboratory section. These records include date of receipt, lot number (when applicable) and expiration date (when applicable).
e) Reagents or working standards that are prepared in house shall be recorded in a logbook: dated, initialed by the analyst preparing the reagent or standard, and entered in the logbook with a unique designation for tracking purposes. Detailed

procedures are outlined in SOP CF01-02 (Standards Documentation and Tracking) and SOP CF01-03 (Reagent Preparation, Documentation and Tracking).

f) Commercial materials purchased for preparation of calibration solutions, spike solutions, etc. are usually accompanied with an assay certificate or the purity is noted on the label. If the assay purity is 96% or better, the weight provided by the vendor may be used without correction. If the assay purity is less than 96% a correction will be made to concentrations applied to solutions prepared from the stock commercial material.

g) Only Class A glassware shall be used in the preparation of any standard or reagent. Any material used in the preparation of a reagent must meet or exceed the quality of the standard or reagent chemical, e.g., solvents used in the preparation of organic standards.

h) Wherever possible, standards must be traceable to NBS/NIST standards, and records to that effect are maintained in the area in which the standard is to be used.

i) Water for the preparation of standards and reagents is provided by a cation, anion, and mixed resin bed deionized water system from Culligan Water Conditioning. The specific conductance of the water produced by this system must be less than 2 μhoms. The conductivity is checked and recorded daily. If the water's conductivity exceeds the specified limit, the Technical Director/Operation Manager(s) are notified immediately, in order to notify all departments on a decision of cession of activities, and make arrangements for correction. Water for metal reagents and standards undergoes an additional purification step, passing through five carbon, resin, and particulate filters. Water used for volatile organic analyses is tap water that is passed through an activated carbon filter.

8.2.2.3 Storage

Reagent and chemical storage is important from the aspects of both reagent integrity and safety. Light-sensitive reagents may be stored in brown-glass containers. Table 8-2 details specific storage instructions.

8.2.3 Waste Disposal

TestAmerica Analytical Testing Corp - Cedar Falls, IA collects, stores, packages, labels, ships, and disposes of wastes in a manner which ensures compliance with all federal, state, and local laws, regulations, and ordinances. Procedures are designed to minimize employee exposure to hazards associated with laboratory-generated wastes and to afford maximum environmental protection.

A waste is a hazardous waste if it is listed in 40 CFR Part 261.30-261.33 or fails any of the criteria in 40 CFR Part 261 Subpart C. Personal knowledge of the waste's characteristics must also be considered. Hazardous wastes must be segregated, labeled appropriately, stored in a designated waste disposal area, and disposed of by a commercial waste disposal company. The Hazardous Waste Officer is responsible for maintaining the on-site system to prepare the wastes for disposal, scheduling removal by the contractor, maintaining records, and assuring that the contractor is permitted, reputable, and trustworthy. The selection of a waste transporter must be predicated on their being permitted to transport hazardous wastes coupled with an absence of RCRA/DOT violations and a proven record of successful performance.

Waste Disposal procedures are detailed in SOP CF10-01.0. Waste solvents from organic extractions and glassware cleaning are stored in drums. Waste methylene chloride is stored separately from other waste solvents. Organic solvents containing PCBs are segregated for disposal with the appropriate manifest. Organic extracts are archived for 40 days before transferal to the appropriate drum for disposal. On a case-by-case basis, samples may be returned to the client; otherwise, the samples are disposed of in accordance with current waste regulations. Sample containers are crushed prior to disposal. Samples known to be very hazardous (e.g., high cyanide) are isolated for special consideration. Expired laboratory reagents which are hazardous are disposed through special laboratory packing procedures by a licensed hazardous waste disposal contractor

Records related to the generation and disposal of hazardous wastes are retained as permanent facility records. Records to be maintained include the following: manifests, inspection reports, waste analysis data, annual reports, certificates of disposal, facility audit reports and documentation of correspondence with federal, state or local regulatory authorities.

Continuing DEMONSTRATION OF CAPABILITY (CDOC) TestAmerica Analytical Tetsing Corp - Cedar Falls Division

Analyst :

Select your Code: Trusha Zimple

Dz

SOP: Number: CF03-18 Name: Determination of Hexavalent Chromium

Instrument Name: DU640

Test:

Analytical: Test Code: 1265 Reference Method: SM 3500-Cr D

Prep: Test Code: 2 Reference Method: NO PREP

Water

Attach Computer Calculation Summary or Complete Table Below:

APG WP JAN 04 Lot 41361

		Analysis Date:	4/6/2005						
		Sample ID:	857196						
Analyte	**Spike Amount**	**Units**	**Result 1**	**Result 2**	**Result 3**	**Result 4**	**Std. Dev**	**Mean**	**%RSD**
Hexachrome	0.124	mg/L	0.118						
	% Recovery		95.2				#DIV/0!	95.2	#DIV/0!
		Prep Batch No.							
		Run Batch No.							
		Data File Names:							
		Acceptance Range	0.101-0.143						

LABSYS Job #(s):

	Prep Log	Analytical Log	Calc. Log
Logbook ID:		CF-1184	
Logbook Pages:		75	

Note: Mean and Standard Deviation should be expressed in the same units (concentration or percent recovery) as the accuracy criteria given in the SOP/Method

Figure 8-1: Demonstration of Capability Documentation – Front Page

Figure 8-1: Demonstration of Capability Documentation – Back Page

Certification Statement:

We, the undersigned, certify that:

1 The cited test method, which is in use at this facility for the analysis of samples under the National Environmental Laboratory Accreditation Program, has met Demonstration of Capability.

2 The test method was performed by the analyst(s) identified on this certification.

3 A copy of the test method and the laboratory-specific SOPs are available for all personnel on site

4 The data associated with the method demonstration of capability are true, accurate, complete, and self-explanatory.

5 The raw data necessary to reconstruct and validate these analyses have been retained at the facility, and the associated information is well organized and available for review by authorized inspectors

	Print Name	Signature	Date
Analyst	Trusha Zimple		
Ops Manager	Kristin Clay		
QA Officer	Mark McGowan		

Figure 8-2: Training Summary Form

TestAmerica
ANALYTICAL TESTING CORPORATION

TRAINING SUMMARY

Date Initiated:

Trainee: ______________________________ **Date Completed:**

Topic(s) of Training (circle): **Non-Analytical (General)** **Analytical Method** **Instrument**

SOP Number: ____________________ Reviewed: ____________________

SOP Signed-Off in training folder: YES NO

I. METHOD/PARAMETER
____

___ Detailed Reference Method/SOP
___ Basic Method/Instrument Theory
___ Safety Precautions
___ Waste Handling
___ Instrument
___ Routine Maintenance
___ Interferences
___ Extraction/Preparation

II. QUALITY CONTROL
___ Calibration Curve, Initial Calibration Verification (ICV) and Continuing Calibration Verification (CCV)
___ Precision/Accuracy
___ MDL Study
___ Review of Chain-of-Custody
___ Documentation (sequences, maintenance, logbooks/worksheets, observations, modifications, standards)
___ QC Requirements (MS/MSD, LCS, Dups, Blanks, Surrogates, Internal Stds, Interference Checks, etc.)
___ Miscellaneous QC (Retention Time Window Studies, IDL, ...)
___ Non-Conformance and Corrective Action Documentation

III. DATA HANDLING AND REPORTING
___ Review Equations and Calculations (concentrations, dry/wet weight)
___ Data Entry or Down-Loading
___ Significant Figures
___ Reporting Dilutions

IV. GENERAL TRAINING
Attach sheet to describe what was discussed. General Training Topics might include: Sample Receiving, Waste Disposal, Shipping, Safety, ...

Results of Start-up QC :

P&A Results Acceptable Y / N / NA . Attach copy of Demonstration of Capabilities

PE Sample Results Acceptable Y / N / NA . Attach copy of Performance Evaluation Sample Results (Summary)

Comments (include any additional training requirements):

Trainee: ______________________ Date: ____________

Trainer: ______________________ Date: ____________

Technical Director: ______________________ Date: ____________

QA Officer: ______________________ Date: ____________

Figure 8-3: Example of a Personnel Qualifications Form

PERSONNEL QUALIFICATIONS

Name: ____.

Title: ____

Education

Month/Year From - To	Degree	Major	College/University
Number of Hours of Chemistry:			

Month/Year	Training Course Name	Training Provider	Brief Description of Course

Laboratory Experience

Number years/months analytical chemistry experience: ____________

Number years/months experience in current field: ____________

Professional Experience

Month/Year From - To	Job Title	Employer - Name and Address

Description

Instruments and Techniques: ______________________________________.

Briefly describe your relevant experience

______________________________ ____________

Signature Date

Figure 8-4:

STATEMENT OF CAPABILITY

(Used to document Current Analysts trained prior to NELAC)

TestAmerica Incorporated – Cedar Falls, IA
704 Enterprise Drive
Cedar Falls, IA 50613-0625

______________________________, has been performing the following analyses:

Matrix Method SOP# **	(Since)	(To)

** - *See attached or reference for analyte, class of analyte or measured parameters.*

The above analyst is proficient in the performance of the above listed analyses due to:

1) Analyst's experience.

2) Analyst has demonstrated the use and understanding of the SOP and referenced methods. The SOP has been signed off on the SOP Sign-off form.

3) Acceptable results on past PT samples such as WP, WS or internal PEs (attach dates of performance).

OR

Page __1__ Of __2__

Figure 8-4: Con't

4) Acceptable Accuracy and Precision on four LCS replicates (attach data or reference location of data).

In addition,

We the undersigned, CERTIFY that:

1. The analyst identified above, using the cited method(s), which is in use at this facility for the analyses of samples under the National Environmental Laboratory Accreditation Program, has met the Demonstration of Capability as described above.

2. The test method(s) was performed by the analyst identified on this certification.

3. A copy of the test method(s) and the laboratory-specific SOPs are available for all personnel on-site.

4. The data associated with the demonstration of capability are true, accurate, complete and self-explanatory.

5. All raw data (including a copy of this certification form) necessary to reconstruct and validate these analyses have been retained at the facility, and that the associated information is well organized and available for review by authorized assessors.

______________________________ ________________
Operations Manager: Date

______________________________ ________________
Division Manager: Date

______________________________ ________________
Quality Assurance Officer: Date

Page __2__ Of __2__

Figure 8.5 Materials Request Sheet

Order List

Week of:__________

VENDOR	CAT. #	ITEM DESCRIPTION	PKG SZ.	PRICE	PAGE	QTY.	INT.

Table 8-1: Laboratory Glassware Cleaning Procedures
(See Glassware Cleaning SOP for alternate Automated Glassware cleaner use)

Analysis/Parameter	Cleaning Procedure (in specified order)
Extractable Organics	5[1], 1, 2, 3, 14, 3, 16, 13, 6
Trace Metals	1, 2, 3, 4, 10, 4, 17, 13
Nutrients , other Wet Chemistry and Bacteriology(dilution bottles)	1, 2, 3, 4, 16, 13, 15
Minerals, CN	1, 2, 3, 4, 16, 13
BOD	1, 2, 3, 4, 11[2],16, 13
Phenols	1, 2, 3 ,4, 13
Cyanide	1, 2, 3, 4, 14, 4, 13

[1]Only Separatory Funnels are rinsed with acetone; other extraction glassware, begin with 1
[2]This procedure need only be performed once a month

Key to laboratory glassware cleaning procedures:

1. Remove all labels.
2. Wash with hot tap water, a brush to scrub inside glassware and stopcocks and other small pieces, if possible, using a suitable laboratory-grade detergent:
   Organics – Liquinox, Alconox or equivalent,
   Inorganic Anions – Liquinox or equivalent,
   Inorganic Cations – Liquinox, Acationox, Micro or equivalent.
3. Rinse thoroughly with hot or warm tap water.
4. Rinse thoroughly with deionized water.
5. Rinse thoroughly with acetone.
6. Rinse thoroughly with pesticide-grade methylene chloride immediately prior to use.
7. Rinse thoroughly with pesticide-grade methanol.
8. Rinse thoroughly with pesticide-grade hexane.
9. Rinse or soak with 1:1 HCl.
10. Rinse or soak with 50% HNO_3.
11. Rinse or soak with 1:1 H_2SO_4

12. Drain, then heat in muffle furnace for 15-30 minutes.

Table 8-1 (cont'd)

13. Stored, inverted or capped with suitable material or container stopper.
14. Soak or rinse with oxidizing agent: NoChromix or equivalent.
15. Rinse with solvent used in analysis as the last step prior to use.
16. Heat to dryness
17. Allow to air dry

TABLE 8-2 STORAGE OF REAGENTS AND CHEMICALS

CHEMICAL	STORAGE REQUIREMENTS
Concentrated acids and bases	1
Standards for metals analysis	2
Standards for extractable organics	3
Standards for volatile organics	4
Bulk dry chemicals	5
Working solutions containing organic compounds	6
Working solutions containing only inorganics	7
Flammable solvents	8
Non-flammable solvents	9

STORAGE REQUIREMENT KEY

1. Stored in the original containers in acid/base cabinets at room temperature. All organic acids must be stored separately from inorganic acids.
2. Stored at room temperature in the metals department.
3. Stored at 4°C± 2°C
4. Neat standards are stored at room temperature in the standard cabinet in the organics department. Stock solutions and working solutions are stored in freezers at 4°C± 2°C
5. Bulk reagents are stored at room temperature in the reagent storage room of the laboratory.
6. Stored refrigerated at 4°C± 2°C in the departments.
7. Stored at room temperature in the department; refrigeration is optional.
8. Stored in solvent cabinets at room temperature
9. Stored separately from the flammable solvents in cabinets at room temperature.

Section 9.0
Calibration Procedures and Frequency

9.1 Instrumentation Lists

Lists of the field and laboratory equipment (including manufacturer's name and model number) used to obtain representative samples and analyze for the parameters listed in Section 5.0 (Quality Assurance Objectives) are provided in Tables 9-1 and 9-2 respectively.

9.2 Standard Traceability

Section 8.2.2 (Reagents/Standards) provides additional information regarding the purchase, tracking, and the use of standards. Standard logbooks serve as a source of documentation to trace internal working standards to primary (purchased) standards. Individual method SOP's describe standard sources required for an analytical method, concentrations of standards to be used, and procedures for preparation of the standards.

9.3 Calibration

Calibration requirements are divided into two parts: requirements for analytical support equipment and requirements for instrument calibration.

9.3.1 Support Equipment

This section applies to all devices that may not be the actual test instrument, but are necessary to support laboratory operations. These include but are not limited to: balances, ovens, refrigerators, freezers, incubators, water baths, temperature measuring devices, thermal/pressure sample preparation devices and volumetric dispensing devices if quantitative results are dependent on their accuracy, as in standard preparation and dispensing or dilution into a specified volume. A summary of support equipment requiring calibration checks can be found in Table 9.3.

Table 9.3 also includes acceptance limits and the proper action in response to unacceptable results. Records of these calibration checks are documented and include (as appropriate):

9.3.1.1 Instrument Model number or a specific lab identification.

9.3.1.2 Identification of standards used for the calibration check.

9.3.1.3 Performance tolerances.

9.3.1.4 Results of the calibration checks, the initials of the individual making the check, and the date of the check.

9.3.1.5 As appropriate, a reference for the procedure used to perform the calibration check.

9.3.2 Operational Calibration

The frequency, acceptance criteria and corrective action of instrument calibration and standardization is summarized in Appendix 4 by method. Method specific Standard Operating Procedures (SOPs) expand on the general discussion following.

9.3.2.1 Calibration Standards

Calibration standards are prepared using the procedures indicated in the Reagents and Standards section of the determinative method SOP. However, the general procedures are described below.

a) For each analyte and surrogate (if applicable) of interest, prepare calibration standards at the minimum number of concentrations as summarized in Appendix 4. If a reference or mandated method does not specify the number of calibration standards, the minimum number is two standards not including blanks or a zero standard.
b) The other concentrations define the working range of the instrument/method or correspond to the expected range of concentrations found in actual samples that are also within the working range of the instrument/method. Results of samples not bracketed by initial instrument calibration standards (within calibration range) must be repeated or the results can be reported having less certainty, e.g., defined qualifiers or flags or explained in a case narrative (with the exception of: ICP methods or other methods where the referenced method does not specify two or more standards). The lowest calibration standard must be at the reporting limit (RL).
c) Given the number of target compounds addressed by some of the organic methods, it may be necessary to prepare several sets of calibration standards, each set consisting of the appropriate number of solutions at different concentrations. The initial calibration will then involve the analysis of each of these sets of the appropriate number of standards (see Appendix 4).
d) All initial calibrations are verified with a standard obtained from a second source and traceable to a national standard, when available.

9.3.2.2 External Standard Calibration Procedure

General calibration procedures are described below for GC and HPLC procedures using non-MS detection. The calibration procedures for other techniques are described within the applicable method SOP.

External standard calibration involves comparison of instrument responses from the sample to the responses from the target compounds in the calibration standards. Sample peak areas (or peak heights) are compared to peak areas (or heights) of the standards. The ratio of the detector response to the amount (mass) of analyte in the calibration standard is defined as the calibration factor (CF).

$$RF = \frac{\text{Mass of the Compound Injected (in nanograms)}}{\text{Peak Area (or Height) of the Compound in the Standard}}$$

For multi-component analytes, see the appropriate method SOP for information on calibration.

The RF can also be calculated using the concentration of the standard rather than the mass in the denominator of the equation above. However, the use of concentrations in RFs will require changes to the equations that are used to calculate sample concentrations.

9.3.2.3 Internal Standard Calibration Procedure

Internal standard calibration involves the comparison of instrument responses from the target compounds in the sample to the responses of specific standards added to the sample or sample extract prior to injection. The ratio of the peak area (or height) of the target compound in the sample or sample extract to the peak area (or height) of the internal standard in the sample or sample extract is compared to a similar ratio derived for each calibration standard. The ratio is termed the response factor (RF), and may also be known as a relative response factor (RRF) in other methods.

In many cases, internal standards are recommended. These recommended internal standards are often brominated, fluorinated, or stable isotopically labeled analogs of specific target compounds, or are closely related compounds whose presence in environmental samples is highly unlikely. If internal standards are not recommended in the method, then the analyst needs to select one or more internal standards that are similar in analytical behavior to the compounds of interest, and not expected to be found in the samples otherwise. The use of specific internal standards is available in the method SOP.

Whichever internal standards are employed, the analyst needs to demonstrate that the measurement of the internal standard is not affected by method analytes and surrogates or by matrix interferences. In general, internal standard calibration is not as useful for GC and HPLC methods with non-MS detectors because of the inability to chromatographically resolve many internal standards from the target compounds. The use of MS detectors makes internal standard calibration practical because the masses of the internal standards can be resolved from those of the target compounds even when chromatographic resolution cannot be achieved.

When preparing calibration standards for use with internal standard calibration, add the same amount of the internal standard solution to each calibration standard, such that the concentration of each internal standard is constant across all of the calibration standards, whereas the concentrations of the target analytes will vary. The internal standard solution will contain one or more internal standards and the concentration of the individual internal standards may differ within the spiking solution (e.g., not all internal standards need to be at the same concentration in this solution). The mass of each internal standard added to each sample extract immediately prior to injection into the instrument or to each sample prior to purging must be the same as the mass of the internal standard in each calibration standard. The volume of the solution spiked into sample extracts should be such that minimal dilution of the extract occurs (e.g., 10 uL of solution added to a 1 mL final extract results in only a negligible 1% change in the final extract volume which can be ignored in the calculations).

An ideal internal standard concentration would yield a response factor of 1 for each analyte. However, this is not practical when dealing with more than a few target analytes. Therefore, as a general rule, the amount of internal standard should produce an instrument response (e.g., area counts) that is no more than 100 times that produced by the lowest concentration of the least responsive target analyte associated with the internal standard. This should result in a minimum response factor of approximately 0.01 for the least responsive target compound.

For each of the initial calibration standards, calculate the RF values for each target compound relative to one of the internal standards as follows:

$$RF = \frac{A(s) \times C(is)}{A(is) \times C(s)}$$

Where:

A(s)	Peak area (or height) of the analyte or surrogate
A(is)	area (or height) of the internal standard
C(s)	Concentration of the analyte or surrogate, in ug/L
C(is)	Concentration of the internal standard, in ug/L

Note that in the equation above, RF is unitless, i.e., the units from the two area terms and the two concentration terms cancel out. Therefore, units other than µg/L may be used for the concentrations of the analyte, surrogate, and internal standard, provided that both C(s) and C(is) are expressed in the same units. The mass of the analyte and internal standard may also be used in calculating the RF value.

9.3.2.4 Evaluating the Linearity of the Initial Calibration

To evaluate the linearity of the initial calibration, calculate the mean RF (avg) (external standard calibration) or mean RRF(avg) (internal standard calibration), the standard deviation (s). To determine the relative standard deviation use the following formulas

$$RSD = \frac{(s)}{RF_{avg}} \times 100$$

or

$$RSD = \frac{(s)}{RRF_{avg}} \times 100$$

RSD is expressed as a percentage (%).

If the RSD of the calibration or response factors is less than or equal to the acceptance limit stated in Appendix 4 over the calibration range, then linearity through the origin may be assumed, and the average calibration response factor may be used to determine sample concentrations. Corrective action procedures are outlined in Appendix 4 and expanded on in Section 9.3.2.5.

9.3.2.5 Percent RSD Corrective Action – Additional Information

Given the potentially large numbers of analytes that may be analyzed in some methods, it is likely that some analytes may exceed the acceptance limit for the RSD for a given calibration. In those instances, the following steps are recommended, but not required.

a) The first step is generally to check the instrument operating conditions. This option will apply in those instances where a linear instrument response is expected. It may involve some trade-offs to optimize performance across all target analytes. For instance, changes to the operating conditions necessary to achieve linearity for problem compounds may cause the RSD for other compounds to increase, but as long as all analytes meet the RSD limits for linearity, the calibration is acceptable.
b) If the RSD for any analyte is greater than the applicable acceptance criteria in Appendix 4, the analyst may wish to review the results (area counts, calibration or response factors, and RSD) for those analytes to ensure that the problem is not associated with just one of the initial calibration standards. If the problem appears to be associated with a single standard, that one standard may be reanalyzed and the RSD recalculated. Replacing the standard may be necessary in some cases.
c) A third alternative is to narrow the calibration range by replacing one or more of the calibration standards with standards that cover a narrower range. If linearity can be achieved using a narrower calibration range, document the calibration linearity, and proceed with analyses. The changes to the upper end of the calibration range will affect the need to dilute samples above the range, while changes to the lower end will affect the overall sensitivity of the method. Consider the regulatory limits or action levels associated with the target analytes when adjusting the lower end of the range.

   When the purpose of the analysis is to demonstrate compliance with a specific regulatory limit or action level, the laboratory must ensure that the calibration standard is near or below the regulatory limit or action level.

d) In those instances where the RSD for one or more analytes exceeds the acceptance criteria, the initial calibration may still be acceptable if the mean of the RSD values for all analytes in the calibration is less than or equal to the acceptance criteria. The mean RSD is calculated by summing the RSD value for each analyte and dividing by the total number of analytes. If no analyte has an RSD above the acceptance criteria, then the mean RSD calculation need not be performed.

   NOTE: The analyst and the data user should be aware that the use of the approach listed in Sec. 9.3.2.5(d) (i.e., the average of all RSD values = the acceptance criteria) will lead to greater uncertainty for those analytes for which the RSD is greater than the acceptance criteria. The analyst and the data user should review the associated quality control results carefully, with particular attention to the matrix spike and laboratory control sample results, to determine if the calibration linearity poses a significant concern. If this approach is not acceptable for a particular application, then the analyst may need to employ another calibration approach (see Sec. 9.3.2.6) or adjust the instrument operating conditions and/or the calibration range until the RSD meets the acceptance criteria.

e) If the conditions in Sec 9.3.2.5 (d) are met, then the average calibration or response factor may be used to determine sample concentrations.

9.3.2.6 Use of other types of calibration (i.e., Linear Calibration Using a Least Squares Regression or Non-Linear Calibration) may be described in manufacturer's manuals or within a published method. These procedures may be utilized providing all initial calibration control criteria specified in the method or SOP is met.

9.3.2.7 Retention Time Windows

Retention time windows are crucial to the identification of target compounds. Absolute retention times are used for compound identification in all GC and HPLC methods that do not employ internal standard calibration. Retention time windows are established to compensate for minor shifts in absolute retention times as a result of sample loadings and normal chromatographic variability. The width of the retention time window should be carefully established to minimize the occurrence of both false positive and false negative results. Tight retention time windows may result in false negatives and/or may cause unnecessary reanalysis of samples when surrogates or spiked compounds are erroneously not identified. Overly wide retention time windows may result in false positive results that cannot be confirmed upon further analysis. The following subsections describe the approach used to establish retention time windows for GC and HPLC methods.

NOTE: The criteria listed in this section are provided for GC and HPLC procedures using non-MS or FTIR detection. Identification procedures are different for GC/MS.

a) Before establishing retention time windows, make sure that the chromatographic system is operating reliably and that the system conditions have been optimized for the target analytes and surrogates in the sample matrix to be analyzed. Make three injections of all single component standard mixtures and multi-component analytes (such as PCBs) over the course of a 72-hour period. Serial injections or injections over a period of less than 72 hours may result in retention time windows that are too tight.

b) Record the retention time for each single component analyte and surrogate to three decimal places (e.g., 0.007). Calculate the mean and standard deviation of the three absolute retention times for each single component analyte and surrogate. For multi-component analytes, choose three to five major peaks (see the determinative methods for more details) and calculate the mean and standard deviation of those peaks.

c) If the standard deviation of the retention times for a target compound is 0.000 (i.e., no difference between the absolute retention times), then the laboratory may either collect data from additional injections of standards or use a default standard deviation of 0.01 minutes. (Recording retention times to three decimal places rather than only two should minimize the instances in which the standard deviation is calculated as 0.000).

d) The width of the retention time window for each analyte, surrogate, and major constituent in multi-component analytes is defined as ± 3 times the standard deviation of the mean absolute retention time established during the 72 hour period. If the default standard deviation in (c) is employed, the width of the window will be 0.03 minutes.

e) Establish the center of the retention time window for each analyte and surrogate by using the absolute retention time for each analyte and surrogate from the calibration verification standard at the beginning of the analytical shift. For samples run during the same shift as an initial calibration, use the retention time of the mid-point standard of the initial calibration.

f) The laboratory must calculate absolute retention time windows for each analyte and surrogate on each chromatographic column and instrument. New retention time windows must be established when a new GC column is installed.

g) If the instrument data system is not capable of employing compound-specific retention time windows, then the analyst may choose a window that minimizes false negatives and positives and apply it to all compounds. As noted above, other approaches may also be employed, but must be documented by the analyst. In general you should not use a window greater than 0.2 to 0.3 minutes. If windows larger than this have been determined a cause should be looked for and the windows should be re-determined.

h) The surrogates are added to each sample, blank, and QC sample and are also contained in each calibration standard. Although the surrogates may be diluted out of certain sample extracts, their retention times in the calibration standards may be useful in tracking retention time shifts. Whenever the observed retention time of a surrogate is outside of the established retention time window, the analyst is advised to determine the cause and correct the problem before continuing analyses.

9.3.2.8 Calibration Verification

The calibration relationship established during the initial calibration must be verified at periodic intervals as specified in Appendix 4. Using varying concentrations of standards over time. The process of calibration verification applies to both external standard and internal standard calibration techniques, as well as to linear and non-linear calibration models.

NOTE: The process of calibration verification referred to is fundamentally different from the approach called "calibration" in some methods. As described in those methods, the calibration factors or response factors calculated during calibration are used to update the calibration factors or response factors used for sample quantitation. This approach, while employed in other EPA programs, amounts to a daily single-point calibration, and is not appropriate nor permitted in SW-846 chromatographic procedures for trace environmental analyses.

As a general rule for MS, the initial calibration must be verified at the beginning of each 12-hour analytical shift during which samples are analyzed. (Some methods may specify more frequent verifications – see Appendix 4). The 12-hour analytical shift begins with the injection of the calibration verification standard (or the MS tuning standard in MS methods). The shift ends after the completion of the analysis of the last sample or standard that can be injected within 12 hours of the beginning of the shift. Initial calibration for GC and HPLC is verified at least every 20 sample injections.

If the response (or calculated concentration) for an analyte is within the acceptance limits (summarized in Appendix 4) of the response obtained during the initial calibration, then the initial calibration is considered still valid, and the analyst may continue to use the RF or RRF values from the initial calibration to quantitate sample results. If the response (or calculated concentration) for any analyte varies from the mean response obtained during the initial calibration by more than the acceptance criteria, then the initial calibration relationship may no longer be valid. If routine corrective action procedures fail to produce a second consecutive (immediate) calibration verification within acceptance criteria, then either the laboratory has to demonstrate performance after corrective action with two consecutive successful calibration verifications, or a new initial instrument calibration must be performed. However, sample data associated with unacceptable calibration verification may be reported as qualified data under the following special conditions:

a) When the acceptance criteria for the calibration verification are exceeded high, i.e., high bias, and there are associated samples that are non-detects, then those non-detects may be reported. Otherwise the samples affected by the unacceptable calibration verification shall be reanalyzed after a new calibration curve has been established, evaluated and accepted.

b) When the acceptance criteria for the calibration verification are exceeded low, i.e., low bias, those sample results may be reported if they exceed a maximum regulatory limit/decision level. Otherwise the samples affected by the unacceptable verification shall be reanalyzed after a new calibration curve has been established, evaluated and accepted.

In keeping with the approach described for initial calibration, if the averages of the responses for all analytes are within the required range in Appendix 4, then the calibration has been verified. However, the conditions in Sec. 9.3.2.5(d) also apply, e.g., the average must include all analytes in the calibration, regardless of whether they are target analytes for a specific project, and the data user must be provided with the calibration verification data or a list of those analytes that exceeded the limit. The effect of using the average of the response for all analytes for calibration verification will be similar to that for the initial calibration - namely, that the quantitative results for those analytes where the difference is greater than the limit will will lead to greater uncertainty. The analyst and the data user should review the note in Sec. 9.3.2.5(d). If the calibration does not meet the limit (either on the basis of each compound or the average across all compounds), check the instrument operating conditions, and if necessary, restore them to the original settings, and inject another aliquot of the calibration verification standard. If the response for the analyte are still not within the acceptance criteria, then a new initial calibration must be prepared.

a) Verification of Linear Calibrations

Calibration verification for linear calibrations involves the calculation of the percent drift or the percent difference of the instrument response between the initial calibration and each subsequent analysis of the verification standard. Use the equations below to calculate % Drift or % Difference, depending on the procedure specified in the method SOP.

$$\%\ \text{Drift} = \frac{(\text{Calculated concentration} - \text{Theoretical concentration})}{\text{Theoretical concentration}} \times 100$$

where the calculated concentration is determined using the mean calibration factor or response factor from the initial calibration and the theoretical concentration is the concentration at which the standard was prepared.

$$\%\ \text{Difference} = \frac{RF(v) - RF_{(avg)}}{RF_{(avg)}} \times 100$$

OR

$$\%\ \text{Difference} = \frac{RRF(v) - RRF_{(avg)}}{RRF_{(avg)}} \times 100$$

Where:

RF(v)	Response Factor
RRF(v)	Relative Response Factor
RF(avg)	Mean Response Factor
RRF(avg)	Mean Relative Response Factor

Except where superseded in certain determinative methods, the % difference or % drift calculated for the calibration verification standard must be within +/- 15% for each analyte, or averaged across all analytes (see Sec 9.3.2.8), before any sample analyses may take place.

b) Verification of a Non-Linear Calibration

Calibration verification of a non-linear calibration is performed using the percent drift calculation described in (a). Calibration verification must be acceptable before any sample analyses may take place. It may also be appropriate to employ two standards at different concentrations to verify the calibration. This is outlined in the method SOP when used.

c) If the continuing instrument calibration results obtained are outside established acceptance criteria, corrective actions must be performed. If routine corrective action procedures fail to produce a second consecutive (immediate) calibration within acceptance criteria, then either acceptance performance after corrective action has to be demonstrated with two consecutive successful calibration, or a new initial instrument calibration must be performed. If acceptable performance has not been demonstrated, sample analysis shall not occur until new calibration curve is established and verified. However, sample data associated with unacceptable calibration verification may be reported as qualified data under the following special occasions.

1. When the acceptance criteria for the continuing calibration verification are exceeded high, i.e., high bias, and there are associated samples that are non-detects, then those non-detects may be reported. Otherwise the samples affected by the unacceptable calibration verification be reanalyzed after a new calibration curve has been established, evaluated and accepted,

2. When the acceptance criteria for the continuing calibration verification are exceeded low, i.e., low bias, those sample results may be reported if they exceed a maximum regulatory limit/decision level. Otherwise the samples affected by the unacceptable verification shall be reanalyzed after a new calibration curve has been established, evaluated and accepted,

d) All target analytes and surrogates, including those reported as non-detects, must be included in a periodic calibration for purposes of retention time confirmation and to demonstrate that calibration verification criteria are being met. The frequency is noted in Appendix 4.

e) Calibration verification may be performed using both high and low concentration standards from time to time. This is particularly true when the ECD or ELCD is used. These detectors drift and are not as stable as FID or PID, and periodic use of the high and low concentration standards serves as a further check on the initial calibration. The concentrations of these standards should generally reflect those observed in samples.

f) Samples analyzed using external standards must be bracketed by periodic analyses of standards that meet the QC acceptance criteria (e.g., calibration and retention time). The results from these bracketing standards must meet the calibration verification criteria and the retention time criteria. However, if the standard analyzed after a group of samples exhibits a response for an analyte that is above the acceptance limit, and the analyte was not detected in any of the previous samples during the analytical shift, then the sample extracts do not need to be reanalyzed, as the verification standard has demonstrated that the analyte would have been detected were it present.

TABLE 9-1
FIELD SAMPLING EQUIPMENT

Quantity	Description/Manufacturer	Model (if applicable)
3	Chlorine Colorimeter/ HACH	46700-00
1	Wastewater Sampler/ ISCO	2710
2	Wastewater Sampler/ ISCO	2910
1	pH meter/ Orion	230A
3	PH meter/ Fisher	13-300-86
1	Hydrogen Peroxide Detection Kit/ Hach	
1	Dissolved Oxygen Detection Kit/ Hach	
1	Soil Sampler Kit /	
1	Air pump/Dayton, Speedaire	42334
3	Air pump, high volume/Gast	1531-107D-G288X
1	Air pump, high volume/Gast	1531-191-G557X
1	DryCal/Bios	DC-2
1	Supplied-Air Respirator/Bullard	EDP 10
2	Groundwater physicals Testing meter/YSI	TLC 3000
33	Personal air sampling pump/SKC	
38	2" x 3' Bailer	
7	2" x 1' Bailer	
1	3" x 3' Bailer	
2	4" x 3' Bailer	
5	Long-handled dippers	
2	Short-handled dippers	
20	Cyclone assemblies	
12	Glass impingers	

TABLE 9-2
LABORATORY EQUIPMENT AND INSTRUMENTATION

Organics / Wet Chemistry / Conventionals / Bacteria Laboratory Equipment and Instrumentation of TestAmerica Analytical Testing Corp Inc. - Cedar Falls Division.

Item	Supplier	Model (If available)
Adiabatic Calorimeter	Parr	1241
Ammonia/Kjeldahl Distillation Unit	Labconco	
Analytical Balance	Mettler	AE160
Analytical Balance (2)	Mettler	PJ300
Analytical Balance	Fisher Scientific	ACCU-124 D
Analytical Balance	Mettler	PM400
Analytical Balance	Mettler Toledo	AX204
Analytical Balance	Sartorius	AC 211 S
Autoclave	Tuttnauer Brinkmann	2540 E
Block Digestor (2), 36-Place	Environmental Express	
Bacteriological Incubator	Frisher Scientific	Isotemp Incubator
Block Digestor	Lachat	BD-46
BOD Incubator	Fisher Scientific	Isotemp 304 R
BOD Incubator	Fisher	Isotemp
BOD Incubator	Precision	815
COD Reactor (3)	Hach	
Conductivity Meter	Corning	441
Constant Temperature Bath (2)	Fisher	Isotemp 228
Constant Temperature Bath (1)	Fisher	101-M
Darkfield Quebec Colony Counter	American Optic	090
Dishwasher	Labconco	Flaskscrubber
Dishwasher, Steam	Labconco	Steamscrubber
Dissolved Oxygen Meter	YSI	52
Dissolved Oxygen Meter	YSI	59
Flashpoint Tester	Fisher-Tag	Flash Tester ASTM D-93
Flashpoint Tester	Fisher-Tag	Cleveland Open-Cup
Forced Air Oven	Precision Scientific	Economy Oven 65- 210 °C
Forced Air Oven	Precision Scientific	Economy Oven 50- 210 °C
Forced Air Oven	Lindberg/Blue	M01450 A-1
Ion Selective Meter	Orion Research	720A
Lachat Wet Chem Autoanalyzer	Lachat	QucikChem 8000
Midi Ammonia Distillation Unit	Kontes	
Midi Cyanide Distillation Unit	Midi-Vap	2000
Muffle Furnace	Thermo Lyne	1400
pH Meter	Orion Research	701A
pH Meter	Orion Research	350
Refrigerator, Walk-In	Elliot-Williams	
Refrigerator, Walk-In	Bangor	
TCLP "Coffin Box" Extractor	TestAmerica	Custom Made
Total Organic Halogen Analyzer (1)	Mitsubishi	TOX-10S

TABLE 9-2 Con't
LABORATORY EQUIPMENT AND INSTRUMENTATION

Organics / Wet Chemistry / Conventionals / Bacteria Laboratory Equipment and Instrumentation of TestAmerica Analytical Testing Corp Inc. - Cedar Falls Division.

Item	Supplier	Model (If available)
Total Organic Halogen Analyzer (1)	Mitsubishi	TOX-100
Total Organic Carbon Analyzer	Dorhrmann	Phoenix 8000
Turbidimeter	Orbeco-Hellige	965-10
UV/Vis Spectrophotometer	Beckman-Coulter	DU 640
UV/Vis Spectrophotometer Printer	Epson	EX800
UV/Vis Spectrophotometer	Milton Roy	Spectronic 401
UV/Vis Spectrophotometer Printer	Citizen	
UV/Vis Spectrophotometer Sampler	Milton Roy	Mr. Sipper
Viscometer	Brookfield	Synchrolect
Water System, De-ionizing	Millipore	Milli-Q
Water System, De-ionizing	Millipore	Milli-Q
Gas Chromatograph/ Mass Spectrometer (3)	Hewlett-Packard	5890/5970
Gas Chromatograph/ Mass Spectrometer (1)	Hewlett-Packard	5890/5972
Gas Chromatograph/ Mass Spectrometer (1)	Hewlett-Packard	6890/5972
Gas Chromatograph/ Mass Spectrometer (2)	Hewlett-Packard	6890/5973
GC/MS Data System (7)	Hewlett-Packard	GC/MS Enviroquant
GC/MS Data Conversion Software	Palisade Corp.	Mass Transit
Freezer (5)	General Electric, and other manufacturers	
HPLC and Autosampler (2)	Hewlett-Packard	1090 Series II with DAD & 1046A Detectors
HPLC and Autosampler (1)	Hewlett-Packard	1100
HPLC Data System (2)	Hewlett-Packard	HP Chemstation
Explosion Proof Refrigerator	CMS:Coulter	Equatherm
Refrigerator (5)	Various Suppliers	
Sonicator (2)		
Zero Headspace Extractor (8)	Millipore	OM-149
Zero Headspace Pressure Vessel (2)	Millipore	
Zero Headspace Rotary Agitator, 4-Place (2)	Millipore	
GC Data System (6)	Scientific Software	EZChrom Elite
GC Data System (2)	Hewlett Packard	GC Enviroquant & Chemstation
GC Dual ECD (1)	Hewlett Packard	5890
GC Dual ECD (1)	Hewlett Packard	5890 Series II
GC Autosampler (4)	Hewlett Packard	7673
GC Autosampler (8)	Hewlett Packard	7673A
GC Dual FID (4)	Hewlett Packard	5890 Series II
GC FID (2)	Hewlett Packard	5890 Series II
GC FID/PID (2)	Hewlett Packard	5890
Sample Concentrator (5)	Tekmar	3000

TABLE 9-2 Con't
LABORATORY EQUIPMENT AND INSTRUMENTATION
Organics Laboratory Equipment and Instrumentation of TestAmerica Analytical Testing Corp, Inc. – Cedar Falls Division.

Sample Concentrator (2)	Tekmar	3100
Purge and Trap autosampler (7)	Varian	ARCHON
Accelerated Solvent Extractor	Dionex	ASE 200
Laboratory Fume Hoods (7)	Kewanee	
Laboratory Fume Hood	Labconco	
Laboratory Fume Hood	Fisher	
GC Auto Sampler (2)	HP	7683
Graphite Furnace Atomic Absorption Spectrophotometer (GFAA) and Data System	Perkin Elmer	AAnalyst 600
Graphite Furnace Atomic Absorption Spectrophotometer (GFAA) and Data System	Perkin Elmer	4100 ZL
Inductively Coupled Plasma Atomic Emission Spectrometer (ICP AES) and Data System	Perkin Elmer	Optima 3000 Radial View
Inductively Coupled Plasma Atomic Emission Spectrometer (ICP AES) and Data System	Perkin Elmer	Optima 3000 Dual View
Mercury Analyzer and Data System	Perkin Elmer	FIMS 100
Ultrasonciator (2)	Sonics	Vibra Cell

Table 9-3
Periodic Calibration

(Table 9-3) **Periodic Calibration**

Instrument	Type of Calibration/ Number of Standards	Frequency	Acceptance Limits	Corrective Action
Analytical Balance	Accuracy determined using Class S or ASTM Class Type 1 weights. (Minimum 4 standards)	Daily	+/- 5 of the last decimal place being verifi	Re-Calibrate according to manufacturers instruction
	Inspected by Accredited Firm	Annually		
	Sensitivity Check	Weekly	Additional load indicated	
Top Loading Balance	Accuracy determined using Class Type 1 or 2 weights. (Minimum of 2 standards)	Daily	+/- 5 of the last decimal place being verified	Recalibrate according to manufacturers instructions
	Inspected by Accredited Firm	Annually		
	Sensitivity Check	Weekly	Additional load indicated	
Class S or ASTM Class Type 1 Weights	Accuracy determined by accredited weights and measurement laboratory.	1 year.	As per certificate.	Replace.
NIST Traceable Thermometer	Accuracy determined by accredited weights and measurement laboratory.	5 years.	As per certificate.	Replace.
Refrigerator	Temperature checked using NIST traceable thermometer.	Daily	As per temperature log sheet posted on unit	Raise or lower temperature, Service called if temperature is not in control within 2 hrs. Refer to CF07-03
Oven	Temperature checked using NIST traceable thermometer.	When in use.	As per method or SOP	Raise or lower temperature
Incubator	Temperature checked using NIST traceable thermometer.	When in use.	As per method or SOP	Raise or lower temperature
Laboratory Thermometers	Accuracy determined by NIST Traceable Thermometer.	Hg – Annually IR – Quarterly	±1°C	Re-calibrate, Remove from service

(Table 9-3) **Periodic Calibration**

Instrument	Type of Calibration/ Number of Standards	Frequency	Acceptance Limits	Corrective Action
Water Bath	Temperature checked using NIST traceable thermometer.	When in use.	As per method or SOP	Raise or lower temperature
Volumetric Dispensing Devices (Eppendorf ® pipet, automatic dilutor or dispensing devices)	Gravimetric/ 1 std. Using water	Monthly.	+/- 4% error	Remove from service
Turbidity Meter	NTU / 3 Standards	As Needed	ICV must be 90-110%	Re-Calibrate according to manufacturers instructions
Conductivity Meter	Coulometric/1 std	As needed	ICV must be 90-110%	Replace probe

Section 10.0
Preventive Maintenance

TestAmerica Analytical Testing Corp – Cedar Falls follows a well-defined program to prevent the failure of laboratory equipment or instrumentation during use. This program of preventative maintenance helps to avoid delays due to instrument failure.

10.1 Routine Preventative Maintenance

Routine preventative maintenance procedures and frequency, such as lubrication, cleaning, and replacements, should be performed according to the procedures outlined in the manufacturer's manual. Manufacturer's Manuals are located near the applicable instrument in the laboratory. Qualified personnel must also perform maintenance when there is evidence of degradation of peak resolution, a shift in the calibration curve, loss of sensitivity, or failure to meet one of the quality control criteria.

10.2 Maintenance Logbook

An instrument maintenance logbook (Figure 10-1) documenting instrument identification, instrument problems, instrument repair and maintenance activities shall be kept for all major pieces of equipment. An instrument maintenance log shall document the following.

10.2.1 Identification of the equipment.
10.2.2 Manufacturer's name
10.2.3 Type of equipment
10.2.4 Model Number
10.2.5 Serial Number
10.2.6 Current Location
10.2.7 Service Company and Service Contact
10.2.8 Additional components

Instrument maintenance logs may also be used to specify instrument parameters. The inside cover of the maintenance log can include a schedule or Tables 10.1 and 10.2 can be used to determine the schedule for routine maintenance. It is the responsibility of each section supervisor to ensure that instrument maintenance logs are kept for all equipment in his/her section. Documentation must include all major maintenance activities such as contracted preventive maintenance and service and in-house activities such as the replacement of electrical components, lamps, tubing, valves, columns, detectors, cleaning and adjustments. Entries must include the date, name of the person performing the service and when appropriate, a statement that the instrument has returned to control and is available for use (state what was used to determine a return to control – CCV acceptable, etc .). When maintenance or repair is performed by an outside agency, service receipts detailing the service performed can be stapled into the logbooks adjacent to pages describing the maintenance performed.

10.3 Instrument Maintenance

In the event of equipment malfunction that cannot be resolved, service shall be obtained from the instrument vendor manufacturer, or qualified service technician, if such a service can be tendered. If on-site service is unavailable, arrangements shall be made to have the instrument shipped back to the manufacturer for repair. Back up instruments, which have been approved, for the analysis shall perform the analysis normally carried out by the malfunctioning instrument. If the back up is not available and the analysis cannot be carried out within the needed timeframe, the samples shall be subcontracted using the procedures outlined within this manual.

10.4 Instrument Overloading

Any item of equipment which has been subjected to overloading or mishandling, or which gives suspect results, or has been shown to be defective shall be taken out of service, clearly identified and wherever possible stored in a different location until it has been repaired and shown by calibration, verification or test to perform satisfactorily. The laboratory shall examine the effect of this defect on previous calibrations or tests.

10.5 Manufacturer Maintenance Contracts

Some of the analytical equipment systems used in the laboratory are currently maintained under manufacturer's service contract. These instruments for which the laboratory manager decided to have a contract; for example the ICP unit, have a full preventative/maintenance service contract which provides instrument adjustment and calibration and priority field service calls for maintenance in the event that equipment failure occurs.

Figure 10-1: Instrument Maintenance Logbook:

Page: 1

Service/Maintenance Record

System: Pest

Manufacturer: Hewlett Packard

Location: Organic prep

Model: 5890A Series II

Serial #: 3033A43537

Servicing Company: Hewlett Packard/Agilent

Telephone/Fax No.: 1-800 227-9770

e-Mail address: [illegible]

Primary Contact or Service Technician: Chris [illegible]

Additional Components (list item, model #, serial number)

	Model #	Serial #
Computer	Vectra VE	4SE11007S
Autosampler tray	18596A	3718A04502
Injection towers	18593A	2936A14674
Controller	18594A	3406A13370

Service Date	Analyst or Service Person/ Company	Service Performed and/or Parts Replaced	Back in Service Indication
7-25-03	CE	Septa, liner, + o-ring changed on front	
7-31-03	CE	septa, liner, + O ring changed on front	
8-6-03	CE	Septa, liner, + o-ring changed on front	
8-7-03	CE	septa, liner, + o ring changed on front	
8-8-03	CE	septa, liner, + O-ring changed on front	
8-12-03	CE	septa, liner, + o-ring changed on front	
8-13-03	CE	septa, liner, + o-ring changed on front	
8-14-03	CE	septa, liner, + o ring changed on front	
8-15-03	CE	septa, liner, + O-ring changed on front	
8-19-03	CE	septa, liner, + O ring changed on front	

Table 10-1 Preventative Maintenance Procedures For Field Equipment

Table 10-1 Field Equipment	**Activity**	**Frequency**	**Maintenance**
Automatic Sampler – ISCO 3710/3910	Check tubing and connections through pump head	Before and after use	Replace tubing when necessary
	Check battery power and program	Before and after use	Replace battery when necessary
	Clean tubing in pump head	After each use	Replace pump head tubing when necessary
	Clean tubing for sample collection	After each use	---
	Check functionality – manual sample; program sample	Prior to use	---
	Check sample container for breakage, etc.	Prior to use	Replace if needed
YSI 3000 – Depth Meter, Temperature, and Conductivity	Check battery	Before and after use	Replace batteries when necessary
	Check cable	Before and after use	Send for repair
	Check probe	Before and after use	Send for repair
	Check LCD	Before and after use	Send for repair
Bailers – Miscellaneous sizes	Check ball valve for overall condition	Prior to use	Clean/replace accordingly
	Check rope	Before, during and after use	Retie or replace as necessary
	Clean inside and out	Before and after use	---
Hydrogen Peroxide – HACH Kit	Inspect condition of glassware	Prior to use	Replace as necessary
	Check expiration dates of reagents	Prior to use	Remove and reorder as necessary
	Clean glassware	After use	---
Residual Chlorine – HACH Kit	Check battery	Before and after use	Replace batteries when necessary
	Inspect glass cells	Before and after use	Replace as necessary
	Clean glass cells	Prior to use	---
Residual Chlorine – HACH Kit	Inspect cell holder	Before and after use	Remove obstructions, if present
	Check expiration dates of reagents	Prior to use	Remove and reorder as necessary
	Inspect ampules for cracks	Before and after use	Replace as necessary
Dissolved Oxygen – HACH Kit	Check battery	Before and after use	Replace batteries when necessary
	Inspect cell holder	Before and after use	Remove obstructions, if present
	Inspect rubber ampule cover	Before and after use	Replace as necessary

Table 10-1 Preventative Maintenance Procedures For Field Equipment (con't)

Table 10-1 Field Equipment	Activity	Frequency	Maintenance
Dissolved Oxygen – HACH Kit	Inspect ampules for cracks	Before and after use	Discard and obtain a new one
pH Meter - generic	Check expiration dates of reagents	Prior to use	Remove and reorder as necessary
	Check battery	Prior to use	Replace as necessary
	Inspect probe or tip	Prior and during use	Replace or clean as necessary
	Check expiration dates of reagents	Prior to use	Remove and reorder as necessary

Table 10-2 Preventative Maintenance Procedures For Laboratory Equipment

Table 10-2 Instrument/ Equipment Type	Maintenance	Frequency
Gas Chromatograph	Replace Gas line dryers and filters	As needed*
	Replace Gas cylinders	As needed*
	Check or adjust column gas flow and/or detector make-up flow	As needed*
	Replace Injection port Septa	Daily*
	Replace Injection port liners/re-silonize liners	GC, As needed; GC/MS, Daily*
	Replace injection port liner o-ring	GC, As needed; GC/MS, Daily*
	Replace inlet seal and ring	GC, As needed, GC/MS, Daily*
	Replace column ferrules	GC, As needed; *
	Clip column (injector and detector end)	GC, As needed; GC/MS, Daily*
	Replace syringes on autosamplers	As needed*
	Replace heated-zones heaters and sensors	As needed*
	Replace inlet assembly	As needed*
	Empty solvent rinse and solvent rinse-waste vials (on autosampler tower)	Daily or as needed
	Replace column	As needed*
Flame Ionization Detector (FID)	Clean/replace jet	As needed*
	Clean collector	As needed*
	Check and/or adjust gas flows	As needed*
	Replace graphite ferrule	After each cleaning (OI detectors only)
Electron Capture Detector (ECD)	Perform wipe test	Yearly*
	Remove and send to authorized agency for cleaning	As needed*
	Check and/or adjust gas flows	As needed*
	Replace gas supply cylinders	As needed*
Photoionization Detector (PID)	Clean window	As needed*
	Replace o-ring seat	As needed*

*Date and maintenance performed are recorded in Maintenance Log of the instrument/equipment

Table 10-2 Preventative Maintenance Procedures For Laboratory Equipment

Table 10-2 Instrument/ Equipment Type	Maintenance	Frequency
Photoionization Detector (PID)	Replace Lamp	As needed*
	Check and/or adjust gas flows	As needed*
	Adjust Lamp power supply intensity	As needed*
Mass Spectrometer (MS)	Clean source, replace source parts, replace filaments	As needed*
	Clean analyzer	As needed*
	Replace electron multiplier	As needed*
	Clean or replace glass jet separator, replace transfer line from jet separator to MS	As needed*
	Change rough pump oil	After each source cleaning
	Refill calibration compound (PFTBA) vial	As needed
Purge and Trap Equipment	Refill rinse water supply/Empty rinse water waste	Weekly or as needed
	Refill spiking solutions vials	As needed
	Rinse sparge tubes	Daily
	Clean or replace 6-port valve	As needed*
	Replace Transfer lines (from Autosampler to LSC and from LSC to GC)	As needed*
	Adjust gas flows and pressures	As needed
	Perform leak check	As needed
Graphite Furnace, Atomic Absorption (GFAA)	Change Graphite contact rings	As needed*
	Clean quartz windows	As needed
	Change graphite tubes and platforms	As needed*
	Refill rinse water	Daily
	Check water cooler water level and filter	Monthly
	Change argon and other gases	As needed*
	Clean or replace sampling probe	As needed
Total Organic Carbon (TOC)	Clean UV Reactor Chamber	Weekly*
	Clean Sparger Tube	Weekly*
	Clean Mist Trap	Weekly*
	Refill rinse/reagent water	As needed
	Clean Gas/Liquid Separator	Weekly*
	Change Liquid in Gas/Liquid Separator	As needed
	Replace Components of Chlorine Scrubber	Weekly*
	Change compressed gas tanks	As needed*
	Replace NDIR Detector	As needed*
	Replace UV Reactor	As needed*
	Replace Tubing	As needed

*Date and maintenance performed are recorded in Maintenance Log of the instrument/equipment

Table 10-2 Preventative Maintenance Procedures For Laboratory Equipment (con't)

Table 10-2 Instrument/ Equipment Type	Maintenance	Frequency
Total Organic Carbon (TOC)	Replace Tubing	As needed
Inductively Coupled Plasma, Atomic Emission Spectrometer (ICP-AES)	Replace Peristaltic pump tubing	As needed*
	Clean autosampler, change tubing	As needed*
	Clean nebulizer and torch assembly	As needed*
	Replace nitrogen and argon tanks	As needed*
	Refill rinse water receptacle	Daily
	Empty waste receptacle	Daily
	Check for internal standard and sample flow through peristaltic pump tubing	As often as possible
	Replace internal standard solution receptacle	As needed
	Operate and check vents	Daily
	Perform Hg alignment	Daily*
	Check water level and water filter on recirculating-cooling unit, refill and replace filter	Check daily, refill and replace as needed
	Check purge windows	Daily, replace as needed
	Replace nebulizer and o-rings	As needed*
	Replace torch	As needed*
	Drain air compressor	Weekly
	Replace mixing chambers	As needed*
	Clean or replace air filters	Weekly
	Check pneumatic filters	Weekly, replace as needed
	Perform wave calibration (UV and Vis)	Quarterly*
	Calibrate Detector	Quarterly*
High Pressure Liquid Chromatography (HPLC)	Replace pre-column filter	As needed*
	Refill Solvent reservoirs	Daily or as needed
	Reverse column and rinse with solvents	Daily or as needed*
	Replace column	As needed*
	Clean solvent reservoir filters	As needed*
	Replace ball-valve cartridges on high pressure pump	As needed*
	Replace DAD flow cell windows	As needed*
	Check system solvent pressure	Daily
pH Meters	Clean or replace electrode	As needed
	Refill electrode electrolyte	As needed
Balance	Clean pan and platform	After each use
	Check Level bubble	Daily
	Check calibration	Daily
	Check sensitivity	Weekly
	Cleaning and calibration by authorized service	Annually
Conductivity Meter	Clean probe	As needed

*Date and maintenance performed are recorded in Maintenance Log of the instrument/equipment

Table 10-2 Preventative Maintenance ProceduresFor Laboratory Equipment (con't)

Table 10-2 Instrument/ Equipment Type	Maintenance	Frequency
Dissolved Oxygen Meter	Replace membrane	As needed
	Clean probe	As needed
ZHE vessels	Replace o-rings and screens	As needed
ZHE and TCLP Tumblers	Check Rotation Rate	Monthly
Spectrophotometers	Clean and check tubing	As needed
Burettes and Pipets	Clean and check calibration	Monthly*
Thermometers	Check calibration	Annually, Quarterly for Digitals and IR Thermometer*
Ovens	Check and/or adjust temperature, record temperature on log sheet	Daily
Refrigerators and Freezers	Check and/or adjust temperature, record temperature on log sheet	Daily
	Defrost freezers	As needed
Accelerated Solvent Extractor	Refill solvent reservoir	Daily or as needed
	Check/Replace/Clean solvent receiver-vial needle	As needed
	Check/Replace/Clean solvent receiver-vial needle	As needed
	Replace cell seals	As needed*
	Clean or replace cell frits	As needed
TOX Analyzer	Replace nitrogen gas tank	As needed
	Change Gas supply tanks (O_2, CO_2)	As needed*
	Replace electrolyte solutions	Daily or as needed
	Replace burn boats	As needed
	Replace or clean sensors	Daily or as needed*
	Replace all o-rings	As needed*
	Clean inner and outer pyrolysis tubes	As needed
	Replace quartz packing in outer pyrolysis tube	As needed*
	Clean or replace drive wires on autosampler	As needed
	Replace plastic tubing on autosampler	As needed
Lachat, Flow Injection Analyzer	Replace* or Rinse 100mL syringes on autosampler	Daily
	Replace tubes on autodilutor	As needed*
	Clean autosample surfaces	As needed
	Spray silicone on cloth and rub on pump rollers	As needed
	Clean or replace o-rings and ports on valves	As needed*
	Clean union and T's on manifold and replace o-rings on manifold	As needed
	Dry and clean detector surfaces	As needed

*Date and maintenance performed are recorded in Maintenance Log of the instrument/equipment

Table 10-2 Preventative Maintenance ProceduresFor Laboratory Equipment (con't)

Table 10-2 Instrument/ Equipment Type	Maintenance	Frequency
Lachat, Flow Injection Analyzer	Replace flow cell o-rings and flares	As needed*
	Replace manifold tubing	As needed*
FIMS Analyzer	Adjust pump timing	As needed
	Change Argon supply tank	As needed*
	Change drying tube	Daily or as needed
	De-clog drying tube and/or reductant tubing	Daily or as needed
	Change system tubing	2-3 weeks*
	Rinse tubing prior to operation and following operation	Daily
	Clean optical cell	As needed (when aperture is out of line)

*Date and maintenance performed are recorded in Maintenance Log of the instrument/equipment

Section 11.0
Quality Control Checks and Routines to Assess Precision and Accuracy and Calculation of Method Detection Limits

TestAmerica Analytical Testing Corp maintains a well-defined internal quality control program. Systems of specific activities are in use in the laboratory to ensure that the analytical data generated is of consistent high quality. Data quality is defined in terms of data quality objectives (DQOs). DQOs are the qualitative and quantitative statements that specify the required level of data quality based on the end use of the data. The laboratory is able to assess data quality by monitoring precision and accuracy. The end user of the data may assess data quality by monitoring completeness, comparability, and representativeness. These terms are defined in Section 5 (Quality Assurance Objectives for the Measurement of Data).

11.1 Quality Control Checks

The following are definitions of specific quality control checks and other relevant terms. The quality control checks are performed as required by method or regulations to assess precision and accuracy. For specific information regarding frequency, control limits and corrective action, see Appendix 4 and Section 5 (Quality Assurance Objectives for the Measurement of Data). Section 9 (Calibration Procedures and Frequency) discusses calibration procedures and Section 13 (Corrective Action) discusses corrective action.

11.1.1 **Analysis Duplicate**: The second measurement of the target analyte(s) performed on a single sample or sample preparation.

11.1.2 **Batch**: Environmental samples which are prepared and/or analyzed together with the same process and personnel, using the same lot(s) of reagents. A **preparation batch** is composed of one to 20 environmental samples of the same matrix, meeting the above mentioned criteria and with a maximum time between the start of processing of the first and last sample in the batch to be 24 hours. An **analytical batch** is composed of prepared environmental samples (extracts, digestates or concentrates) and /or those samples not requiring preparation, which are analyzed together as a group using the same calibration curve or factor. An analytical batch can include samples originating from various environmental matrices and can exceed 20 samples.

11.1.3 **Blank:** A sample that has not been exposed to the analyzed sample stream in order to monitor contamination during sampling, transport, storage or analysis. The blank is subjected to the usual analytical and measurement process to establish a zero baseline or background value and is sometimes used to adjust or correct routine analytical results.

11.1.4 **Blind Sample**: A sample for analysis with a composition known to the submitter. The analyst/laboratory may know the identity of the sample but not its composition. It is used to test the analyst's or laboratory's proficiency in the execution of the measurement process.

11.1.5 **Calibrate:** To determine, by measurement or comparison with a standard, the correct value of each scale reading on a meter or other device, or the correct value for each setting of a control knob. The levels of the applied calibration standard should bracket the range of planned or expected sample measurements.

11.1.6 **Detection Limit:** The lowest concentration or amount of the target analyte that can be determined to be different from zero by a single measurement at a stated degree of confidence.

11.1.7 **Dilution Test:** A recommended quality control sample used in metals analysis whenever a new or unusual sample matrix is encountered. It will ensure that neither positive nor negative interferences are operating on any of the analyte elements to distort the accuracy of the reported values. If the analyte concentration is sufficiently high (minimally, a factor of 10 above the instrumental detection limit after dilution), an analysis of a 1:5 dilution should agree within +/- 10% of the original determination. If not, a chemical or physical interference effect should be suspected.

11.1.8 **Duplicate Analyses:** The analyses or measurements of the variable of interest performed identically on two subsamples of the same sample. The results from duplicate analyses are used to evaluate analytical or measurement precision but not the precision of sampling, preservation or storage internal to the laboratory. The analyst will choose the sample from the preparation or run batch that has the lowest numerical sample ID, sufficient volume/mass for the initial analyses and the duplicate analyses (See 11.1.16 – Matrix Spike Duplicate.)

11.1.9 **Internal Standard:** A known amount of standard added to a test portion of a sample and carried through the entire measurement process as a reference for evaluating and controlling the precision and bias of the applied analytical test method.

11.1.10 **Laboratory Control Sample (LCS)**: A sample matrix, free from the analytes of interest, spiked with verified known amounts of analytes from a source independent of the calibration standards or a material containing known and verified amounts of analytes. It is generally used to establish intra-laboratory or analyst specific precision and bias or to assess the performance of all or a portion of the measurement system. The LCS is commonly referred to as a laboratory fortified blank (LFB).

An LCS shall be analyzed at a minimum of 1 per batch of 20 or less samples per matrix type per sample extraction or preparation method except for analytes for which spiking solutions are not available such as total suspended solids, total disolved solids, total volatile solids, total solids, pH, color , odor, temperature, dissolved oxygen or turbidity. The results of these samples shall be used to determine batch acceptance. Note: NELAC standards allow a matrix spike to be used in place of this control as long as the acceptance criteria are as stringent as for the LCS. (Also see 11.1.25 – Spike, Section 11.2.4 and Appendix 4.)

11.1.11 **Laboratory Duplicate:** Aliquots of a sample taken from the same container under laboratory conditions and processed and analyzed independently.

11.1.12 **Limit of Detection (LOD):** The lowest concentration level that can be determined by a single analysis and with a defined level of confidence to be statistically different from a blank.

11.1.13 **Limit of Quantitation (LOQ)**: The level above which quantitative results may be obtained with 99% confidence. This value is statistically determined as 10 times the standard deviation from a MDL Study.

11.1.14 **Matrix Spike (spiked sample, fortified sample)**: Prepared by adding a known mass of target analyte to a specified amount of matrix sample for which an independent estimate of target analyte concentration is available. Matrix spikes are used, for example, to determine the effect of the matrix on a method's recovery efficiency.

Matrix spikes shall be performed at a frequency of one in 20 samples per matrix type per sample extraction or preparation method except for analytes for which spiking solutions are not available such as, total suspended solids, total dissolved solids, total volatile solids, total solids, pH, color, odor, temperature, dissolved oxygen, turbidity, BOD or for preparation batches for which no additional sample is possible for a matrix spike and matrix spike duplicate preparation (such as PCBs in wipe samples). The analyst will choose the sample from the preparation or run batch that has the lowest numerical sample ID, sufficient volume/mass for the initial (unspiked) analysis and MS/MSD analyses, and that has a matrix that is representative of the remainder of the samples in the batch. The criterion for this selection is that there be sufficient quantity for unspiked sample and MS/MSD preparation. If insufficient sample would result in raising a reporting limit that exceeds a required level, then a LCS/LCSD will be prepared in place of the MS/MSD. The selected sample(s) shall be rotated among client samples so that various matrix problems may be noted and/or addressed. Poor performance in a matrix spike may indicate a problem with the sample composition and shall be reported to the client whose sample was used for the spike. (Also see 11.1.25 – Spike, Section 11.2.4 and Appendix 4.)

11.1.15 **Matrix Spike Duplicate (spiked sample/fortified sample duplicate)**: A second replicate matrix spike is prepared in the laboratory and analyzed to obtain a measure of the precision of the recovery for each analyte.

Matrix spike duplicates or laboratory duplicates shall be analyzed at a minimum of 1 in 20 samples per matrix type per sample extraction or preparation method. If a client does not supply sufficient sample designated for MS/MSD preparation and analysis, it is the responsibility of the analyst preparing the sample to select a sample for MS/MSD preparation and analysis. The analyst will choose the sample from the preparation or run batch that has the lowest numerical sample ID, sufficient volume/mass for the initial (unspiked) analysis and MS/MSD analyses, and that has a matrix hat is representative of the remainder of the samples in the batch. The criterion for this selection is that there be sufficient quantity for unspiked sample and MS/MSD preparation. If insufficient sample would result in raising a reporting limit that exceeds a required level, then a LCS/LCSD will be prepared in place of the MS/MSD. The selected sample(s) shall be rotated among client samples so that various matrix problems may be noted and/or addressed. Poor performance in the duplicates may indicate a problem with the sample composition and shall be reported to the client whose sample was used for the duplicate.

11.1.16 **Method Blank**: A sample of a matrix similar to the batch of associated samples (when available) in which no target analytes or interferences are present at concentrations that impact the analytical results for sample analyses.

The source of contamination must be investigated and measures taken to correct, minimize or eliminate the problem if the blank contamination exceeds a concentration greater than 1/10 of the measured concentration of any sample in the associated sample batch. Any sample associated with the contaminated blank shall be reprocessed for analysis or the results reported with the appropriate data qualifier.

11.1.17 **Method Detection Limit**: The minimum concentration of a substance (an analyte) that can be measured and reported with 99% confidence that the analyte concentration is greater than zero and is determined from analysis of a sample in a given matrix containing the analyte.

11.1.18 **Method of Standard Additions (MSA)**: In metals analysis, when the method of standard additions is used, standards are added at one or more levels to portions of a prepared sample. This technique compensates for enhancement or depression of an analyte signal by a matrix. It will not correct for additive interferences, such as contamination, interelement interferences, or baseline shifts. An alternative to using the method of standard additions is the internal standard technique. Add one or more elements not in the samples and verified not to cause an interelement spectral interference to the samples, standards and blanks.

11.1.19 **Post Digestion Spike**: A recommended quality control sample used in metals analysis whenever a new or unusual sample matrix is encountered. The spike is added to the sample after digestion. It is a test for matrix interference (positive or negative bias). The spike addition should produce a minimum level of 10 times and a maximum of 100 times the instrumental detection limit. If the spike is not recovered within the specified limits, a matrix effect should be suspected.

11.1.20 **Quality Control Check Sample (Initial Calibration Verification, ICV)**: An uncontaminated sample with known amounts of analytes from a source independent from the calibration standards. It is generally used to establish intra-laboratory or analyst specific precision and bias or to assess the performance of all or a portion of the measurement system.

11.1.21 **Quality Control Check Standard**: In general, these samples are prepared similarly to an LCS, except that the reagent water is spiked with all compounds of interest. It must be from an independent source from the calibration standards. The standard is generally required in 40 CFR Part 136 methods (e.g. EPA 624) due to the long list of analytes and the risk that the spiked sample may have some analytes outside of control limits. Note the required concentration of the standard as described within the published method or laboratory SOP. This standard is also known as the Initial Calibration Verification (ICV).

11.1.22 **Range:** The difference between the minimum and the maximum of a set of values.

11.1.23 **Reagent Blank (method reagent blank)**: A sample consisting of reagent(s), without the target analyte or sample matrix, introduced into the analytical procedure at the appropriate point and carried through all subsequent steps to determine the contribution of the reagents and of the involved analytical steps.

11.1.24 **Reporting Limit:** A value that is above the MDL but below a regulatory or action level for a particular parameter. This value is a convenient value that is reported to the client and below which, a non-detect for the analyte is indicated. The reporting limit is subject to adjustments for dilutions, sample volumes and weights, sample moisture and interferences.

11.1.25 **Reporting Limits Verification Standard (RLVS)**: A sample matrix, free from the analytes of interest, spiked with verified known amounts of analytes from a source independent of the calibration or a material containing known and verified amounts of analytes at a concentration near the reporting limit. This standard evaluates instrument performance at the reporting limit concentration.

11.1.26 **Spike:** A known mass of target analyte added to a blank, sample or subsample; used to determine recovery efficiency or for other quality control purposes.

If the mandated or requested test method does not specify the spiking components, the laboratory shall spike all reportable components to be reported in the Laboratory Control Sample and Matrix Spike. However, in cases where the components interfere with accurate assessment (such as simultaneously spiking chlordane, toxaphene and PCBs in Method 608), the test method has an extremely long list of components or components are incompatible, a representative number (at a minimum 10%) of the listed components may be used to control the test method. The selected components of each spiking mix shall represent all chemistries, elution patterns and masses, permit specified analytes and other client requested components. However, the laboratory shall ensure that all reported components are used in the spike mixture within a two-year time period.

11.1.27 **Split Samples**: Aliquots of a sample taken from the same container are analyzed independently. In cases where aliquots of samples are impossible to obtain, field duplicate samples should be taken for the matrix duplicate analysis. These are usually taken after mixing or compositing and are used to document intra- or inter-laboratory precision.

11.1.28 **Surrogate**: A substance with properties that mimic the analyte of interest. It is unlikely to be found in environmental samples and is added to them for quality control purposes.

Surrogate compounds must be added to all samples, standards, and blanks, for all organic chromatography methods except when the matrix precludes its use or when a surrogate is not available. Poor surrogate recovery may indicate a problem with sample composition and shall be reported to the client whose sample produced poor recovery. (Also see Section 11.2.4 and Appendix 4.)

11.2 Generating Control Limits for Precision and Accuracy

Historical data that the laboratory generates are used to calculate in-house control limits for matrix spike recoveries, surrogate recoveries and laboratory control sample recoveries. The development of in-house control limits and the use of control charts or similar procedures to track laboratory performance are important.

11.2.1 Accuracy

Accuracy is estimated from the recovery of spiked analytes from the matrix of interest. For each matrix spike sample analyzed, calculate the percent recovery of each matrix spike compound added to the sample, as described in Section 12.1.3 (Data Reduction, Validation and Reporting).

For each collected sample, calculate the percent recovery of each analyte, as follows:

$$\text{Recovery (\%)} = \frac{\text{Concentration (or amount) found}}{\text{Concentration (or amount) added}} \times 100$$

11.2.1.1 Calculate the average percent recovery (p) and the standard deviation (s) for each of the spiked analytes. Control limits are evaluated and adjusted about every six months for established methods. For new methods, calculate the average percent recovery (p) and the standard deviation (s) for each of the analytes after analysis of 15-20 collected samples of the same matrix, in a similar fashion.

11.2.1.2 Calculate upper and lower control limit for each matrix spike or surrogate compound, as follows:

Upper control limit = $p + 3(s)$

Lower control limit = $p - 3(s)$

11.2.2 Precision

Calculation of Precision - Precision is estimated from the relative percent difference (RPD) of the concentrations (not the recoveries) measured for matrix spike/matrix spike duplicate pairs, or for duplicate analyses of unspiked samples. For each matrix spike/matrix spike duplicate or sample and sample duplicate analyzed, calculate the relative percent difference, as described in Section 12.1.4 (Data Reduction, Validation and Reporting).

11.2.2.1 Calculate the average (p) and the standard deviation (s) for each of the duplicated analytes. Use data collected over a six-month period for each method performed for each matrix. For new methods, default control and warning limits are used until the 6-month period expires or at least 20 data points are available.

11.2.2.2 Calculate control limits for each compound (since RPD or range are expressed as a positive number, there can be no lower control limit, as that value would be a negative number), as follows:

Control limit = $p + 3(s)$

11.2.3 Control limits approximate a 99% confidence interval around the mean, while warning limits approximate a 95% confidence interval. Statistically, sixty-eight percent of all results should fall within one standard deviation of the mean. Statistically, seven consecutive results on one side or the other of the mean indicate an anomaly that should be corrected, while three consecutive results exceeding warning limits also indicate an event that should be investigated.

11.2.4 Any matrix spike, surrogate, or LCS result outside of the control limits requires evaluation by the laboratory. Such actions should begin with a comparison of the results from the samples or matrix spike samples with the LCS results. If the recoveries of the analytes in the LCS are outside of the control limits, then the problem may lie with the application of the extraction and/or cleanup procedures applied to the sample matrix or with the chromatographic procedures. Once the problem has been identified and addressed, corrective action may include the re-analysis of samples, or the extraction and analysis of new sample aliquots, including new matrix spike samples and LCS. When the LCS results are within the control limits, the problem may either be related to the specific sample matrix or to an inappropriate choice of extraction, cleanup, and determinative methods. For a further discussion of corrective action, see Appendix 4.

Control (acceptance) limits are printed and updated at least semi-annually. Once limits are updated, the new limits are posted in the laboratory (dated and approved by an Operations Manager, Division Manager, and Quality Assurance Officer) and entered into the LIMS. The Quality Assurance Officer maintains an archive of all limits used within the laboratory with the effective dates. The control limits used to evaluate sample results are those that are in place at the time of sample analysis.

11.2.5 For methods and matrices with very limited data (e.g., unusual matrices not analyzed often), interim limits are established using available data or by analogy to similar methods or matrices.

11.2.6 Results used to develop acceptance criteria must meet all other QC criteria associated with the determinative method. For instance, matrix spike recoveries from a GC/MS procedure are generated from samples analyzed after a valid GC/MS tune and a valid initial calibration that includes the matrix spike compounds. Another example is that analytes in GC or HPLC methods must fall within the established retention time windows in order to be used to develop acceptance criteria.

11.2.7 It is advisable to consider the effects of the spiking concentration on matrix spike control limits, and to avoid censoring of data. The acceptance criteria for matrix spike recovery and precision are often a function of the spike concentration used. Therefore, caution must be used when pooling matrix spike/matrix spike duplicate data to generate control limits. Not only should the results all be from a similar matrix, but the spiking levels should also be approximately the same (within a factor of 2). Similarly, the matrix spike and surrogate results should all be generated using the same set of extraction, cleanup, and analysis techniques. For example, results from solid samples extracted by ultrasonic extraction are not mixed with those extracted by automated solvent extraction.

11.2.8 Another common error in developing acceptance criteria is to discard data that do not meet a preconceived notion of acceptable performance. These results in a censored data set, which, when used to develop acceptance criteria, will lead to unrealistically narrow criteria. Remember that for a 95% confidence interval, 1 out of every 20 observations likely will still fall outside the limits. While professional judgment is important in evaluating data to be used to develop acceptance criteria, specific results are not discarded simply because they do not meet one's expectations. Rather, a statistical test for outlier values is employed (see Section 11.3).

11.2.9 In-house QC limits must be examined for reasonableness. Poor recoveries should not be legitimized due to the incorrect choice of methods or spiking levels. In-house limits are important when considering the objectives of specific analyses. For example, recovery limits that include allowance for a relatively high positive bias (e.g., 70 - 170%) may be appropriate for determining that an analyte is not present in a sample. However, they would be less appropriate for the analysis of samples near but below a regulatory limit, because of the potential high bias.

It may be useful to compare QC limits generated in the laboratory to the performance data that may be listed in specific determinative methods. However, be aware that performance data generated from multiple-laboratory data tend to be significantly wider than those generated from single-laboratory data. In addition, comparisons between in-house limits and those from other sources should generally focus more on the accuracy (recovery) limits of single analyses rather than the precision limits. For example, a mean recovery closer to 100% is generally preferred, even if the ±3 standard deviation range is slightly wider, because those limits indicate that the result is likely closer to the "true value." In contrast, the precision range provides an indication of the results that might be expected from repeated analyses of the same sample.

11.2.10 Control Limit Evaluation

In order for easier data review and validation, round the lower control limits to the next lower percentage ending in a "0" or "5" and round the upper control limits to the next higher percentage ending in a "0" or "5". RPD limits are rounded upwards to the next "0" or "5".

11.2.11 Control Limit Boundaries

11.2.11.1 Regardless of the calculated limit, the limit should be no tighter than the initial calibration verification (ICV) control limits. (Unless the analytical method specifies a tighter limit)

11.2.11.2 In-house limits cannot be any wider than those mandated in the regulated method.

11.2.11.3 The lowest acceptable recovery limit will be 10%.

11.2.11.4 The maximum acceptable recovery limit will be 150%.

11.2.11.5 The maximum acceptable RPD limit will be 35% for waters and for soils 50%

11.2.11.6 If either the high or low end of the control limit changes by =5% from previous, visually inspect the control chart and if there is no affect on laboratory ability to meet the existing limits, leave them unchanged.

11.3 Statistical Outlier Tests

It is important to exclude extreme measurements from a data set to eliminate bias in statistical evaluations such as control limit calculations or Method Detection Limit (MDL) studies. Extreme or atypical values are often referred to as outliers because of their location outside the normal distribution curve. When data measurements are normally distributed, certain statistical assumptions can be made about the data: about 68% of the measurements will be within one standard deviation of the mean; about

95% of the measurements will be within two standard deviations of the mean; and about 99% of all measurements will be within three standard deviations of the mean.

Outliers can significantly alter the outcome of an MDL Study. Outliers can lead to increased variability, and therefore a larger standard deviation. Theoretically, no result should be rejected, because it may indicate either a faulty technique that casts doubt on all results or the presence of a true variant in the distribution. An MDL calculated using outliers would be inaccurate and higher than the actual detection limit. For this reason, it is important to recognize outliers, and to reject them from the calculation of the MDL. Known outliers, that is, the result of any analysis in which an error is known to have occurred (i.e., a leak during extraction/distillation, incorrect integration), should automatically be rejected from the data set.

11.3.1 Z Score

Z-scores can be calculated for large sample sizes (greater than 30 data points), and thus are useful to determine if a value should be excluded from a calculation of control limits. A Z-score of greater than 4 is an indication that the data point in question is an outlier. The Z-score is calculated as follows:

$$Z = \frac{\text{Abs}\,(x - x_{avg})}{s}$$

Where:

Z = Z-score
Abs = Absolute value
x = measurement in question
x_{avg} = measurement in question
s = standard deviation of the measurements

11.3.2 Grubbs' T test

The Grubbs' T test is an objective test for determining whether a point is an outlier in a smaller data set (less than 20 data points). The Grubbs' T value is calculated as follows:

$$T = \frac{\text{Abs}\,(x - x_{avg})}{s}$$

Where:

T = Grubb's T value
Abs = Absolute value
x = measurement in question
x_{avg} = measurement in question
s = standard deviation of the measurements

The result of the calculation is compared against the value of T from Table 11-1, using the appropriate number of measurements and the acceptable rejection factor (the 5% rejection factor is presented here). If the Grubbs' T value is greater than the value of T from the table, the data point in question is a statistical outlier, and should be rejected from the data set.

11.4 Procedure for the Determination of the Method Detection Limit (MDL)

The MDL defined below is adapted from 40CFR Part 136, Appendix B, Revision 1.11. If another procedure is used to determine a Limit of Detection, it is important that the correct terminology be applied (i.e., Detection Limit, Limit of Detection), as MDL is defined to mean the procedure outlined in 40CFR Part 136. Similarly, Limit of Quantitation is defined on the basis of this MDL study. Reporting Limit and Quantitation Limit are not interchangeable with Limit of Quantitation.

11.4.1 Scope and Application

This procedure is designed for applicability to a wide variety of sample types ranging from reagent water spiked with the analyte, to wastewater containing analyte, to sand or other sold matrices containing the analyte. The MDL for an analytical procedure may vary as a function of sample type. The procedure requires a complete, specific, and well-defined analytical method. It is essential that all sample-processing steps of the analytical method be included in the determination of the MDL. The MDL obtained by this procedure is used to judge the significance of a single measurement of a future sample. The MDL procedure was designed for applicability to a broad variety of physical and chemical methods, and should be performed in both aqueous and non-aqueous matrices (where samples are analyzed in both matrix types). MDLs must be determined each time there is a significant change in the test method or instrument type. A MDL study is not required for any component for which spiking solutions or quality control samples are not available, such as odor and temperature.

11.4.2 Procedure

11.4.2.1 Make an estimate of the detection limit using one of the following:

a) The concentration value that corresponds to an instrument signal/noise in the range of 2.5 to 5.
b) The concentration equivalent of three times the standard deviation of replicate instrumental measurements of the analyte in reagent water.
c) That regions of the standard curve where there is a significant change in sensitivity, i.e., a break in the slope of the standard curve.
d) Instrumental limitations.
e) It is recognized that the experience of the analyst is important to this process. However, the analyst must include the above considerations in the initial estimate of the detection limit.

11.4.2.2 Prepare a matrix (i.e., reagent water) that is as free of analyte as possible. Reagent or interference free water is defined as a water sample in which analyte and interferant concentrations are not detected at the MDL of each analyte of interest. Interferences are defined as systematic errors in the measured analytical signal of an established procedure caused by the presence of interfering species (interferant). The interferant concentration is presupposed to be normally distributed in representative samples of a given matrix.

11.4.2.3 Matrix choice

a) If the MDL is to be determined in reagent water, prepare a laboratory standard at a concentration which is at least equal to or in the same concentration range as the estimated detection limit (recommend between 1 and 5 times the estimated detection limit). Proceed to Step 11.4.2.4.
b) If the MDL is to be determined in another sample matrix, analyze the sample. If the measured level of the analyte is in the recommended range of one to five times the estimated detection limit, proceed to Step 11.4.2.4. (Note: Clean sand may also be spiked to determine the MDL for solids.)

    1. If the measured level of analyte is less than the estimated detection limit, add a known amount of analyte to bring the level of analyte between one and five times the estimated detection limit.

    2. If the measured level of analyte is greater than five times the estimated detection limit, there are two options.

        A. Obtain another sample with a lower level of analyte in the same matrix if possible.

        B. This sample may be used as is for determining the MDL if the analyte level does not exceed 10 times the MDL of the analyte in reagent water. The variance of the analytical method changes as the analyte concentration increases from the MDL; hence the MDL determined under these circumstances may not truly reflect method variance at lower analyte concentrations.

11.4.2.4 Analysis

a) Take a minimum of seven aliquots of the sample to be used to calculate the MDL and process each through the entire analytical method. Make all computations according to the defined method with final results in the method reporting units. If a blank measurement is required to calculate the measured level of analyte, obtain a separate blank measurement for each sample aliquot analyzed. Where allowed by the method, the average blank measurement is subtracted from the respective sample measurements.

b) It may be economically and technically desirable to evaluate the estimated MDL before proceeding with 11.4.2.4a. This will: (1) Prevent repeating this entire procedure when the costs of analyses are high and (2) insure that the procedure is being conducted at the correct concentration. It is quite possible that an inflated MDL will be calculated from data obtained at many times the real MDL even though the level of analyte is less than five times the calculated MDL. To insure that the estimate of the MDL is a good estimate, it is necessary to determine that a lower concentration of analyte will not result in a significantly lower MDL. Take two aliquots of the sample to be used to calculate the MDL and process each through the entire method, including blank measurements as described above in 11.4.2.4a. Evaluate these data:

1) If these measurements indicate the sample is in desirable range for determination of the MDL, take five additional sample aliquots and proceed. Use all seven measurements for calculation of the MDL.

2) If these measurements indicate the sample is not in correct range, re-estimate the MDL, obtain new sample as in 11.4.2.3 and repeat either 11.4.2.4a or 11.4.2.4b.

11.4.2.5 Calculate the standard deviation (s) of the replicate measurements.

11.4.2.6 Compute the MDL, as follows:

$$MDL = t_{(n-1, 1-\mu = 0.99)}(s)$$

Where

$t_{(n-1,1-\mu = 0.99)}$ = Students' t value appropriate for a 99% confidence level and a standard deviation estimate with n-1 degrees of freedom (see Table 11-2).

s = standard deviation of the replicate analyses

11.4.3 Reporting

The analytical method used must be specifically identified by number and method title. The date of the study, instrument ID and the name of the analyst(s) performing the analysis must be included. If the analytical method permits options that affect the MDL, these conditions must be specified with the MDL value (i.e., sample preparation methods, columns, detectors). The sample matrix, date of calibration and the standard (ID# and concentration) used must be documented. The MDL for each analyte must be expressed in the appropriate method reporting units. Report the mean analyte level with the MDL. If a laboratory standard or a sample that contained a known amount of analyte was used for this determination, also report the mean recovery. If the level of analyte in the samples was below the determined MDL or exceeded 10 times the MDL of the analyte in reagent water, do not report a value for the MDL. An example format for documenting each MDL can be found in Figure 11-1.

11.5 Measurement of Uncertainty

When estimating uncertainty of a measurement, all uncertainty components that are of importance in the given situation must be taken into account.

11.5.1 The uncertainty of the analyses are estimated by one of three systems or a combination there of.

11.5.1.1 The dispersion of values obtained from known standards or samples is measured and calculated.

11.5.1.2 The uncertainty of each of the steps in the analytical process is measured or estimated and combined into one overall uncertainty.

11.5.1.3 The values are derived from the mean value (average) of a laboratory control sample or another quality control sample in which a known concentration is added to a sample matrix. Uncertainty of a method is then calculated by subtracting the theoretical vale (100) from the mean of the percent recoveries for a particular analyte.

Mean of recoveries – Theoretical Value	=	Uncertainty of method

11.5.2 Derived uncertainty measurements for methods performed by TestAmerica Analytical Testing Corp – Cedar Falls are calculated on a client requested basis.

Figure 11-1: Example MDL Reporting Format

Analyte	Fluoride
Method Reference	4500-F,B,C
Prep Method Reference	
Instrument	probe
Date Analyzed	8/13/01
Analyst	tlz
Martix Type	water
SpikeConc	0.2
Units	mg/L
Standard ID Number	4204
Number of Replicates	10
MDL1	0.24500
MDL2	0.22500
MDL3	0.21800
MDL4	0.21200
MDL5	0.21500
MDL6	0.20300
MDL7	0.20300
MDL8	0.20600
MDL9	0.20300
MDL10	0.20300
T-Value	2.8210
Average	0.2133
Standard Deviation	0.013524053
Signal to Noise	15.77189956
Signal to Noise Check	S/N In TA Range
MDL	0.038151353
MDL comapred to spike	OK
LOQ	0.135240526
Reporting Limit	0.2

Table 11-1: Critical Values for Grubbs' T

Number of Data Points	Critical Value
7	1.94
8	2.03
9	2.11
10	2.18
12	2.29
14	2.37
15	2.41
16	2.44
18	2.50
20	2.56

Table 11-2: Students' t-Values at the 99 Percent Confidence Level

Number of replicates (n)	Degrees of freedom (n-1)	$t_{(n-1, .99)}$
7	6	3.143
8	7	2.998
9	8	2.896
10	9	2.821
11	10	2.764
12	11	2.718
13	12	2.681
14	13	2.650
15	14	2.624
16	15	2.602
17	16	2.583
18	17	2.567
19	18	2.552
20	19	2.539

Section 12.0
Data Reduction, Validation and Reporting

12.1 Data Reduction

Analytical results are reduced to appropriate concentration units specified by the analytical method, taking into account factors such as dilution, sample weight or volume, etc. Blank correction will be applied only when required by the method/ per manufacturer's indication, otherwise, it should not be performed. Calculations are independently verified by appropriate laboratory staff. If the formulas outlined in this section are not used, the correct formula can be found in the appropriate method SOP.

12.1.1 The analyte concentration in a sample analyzed using external standard calibration can be determined by:

$$\text{Concentration (ppb)} = \frac{(A_s)(V_t)(D)}{(\text{avgRF})\ (V_i)\ (S)}$$

Where:

A_s	=	area of the peak for the analyte in the sample
V_t	=	total volume of the extract in µL (for purge and trap analysis V_t=1)
D	=	dilution factor(if no dilution is performed D=1)
avgRF	=	the mean response factor from the initial calibration in area/ng
V_I	=	volume of the extract injected in µL (for purge and trap analysis V_I=1)
S	=	sample volume or mass (in mL or g) extracted or purged

12.1.2 The analyte concentration in a sample analyzed using internal standard calibration can be determined by:

$$\text{Concentration (ppb)} = \frac{(A_s)(C_{is})(V_t)(D)}{(A_{is})(\text{avgRRF})(S)}$$

Where:

A_s	=	area of the peak for the analyte in the sample
C_{is}	=	the concentration of the internal standard
V_t	=	total volume of the extract in mL (for purge and trap analysis V_t=1)
D	=	dilution factor(if no dilution is performed D=1)
A_{is}	=	area of the internal standard
avgRRF	=	the mean response factor from the initial calibration in area/ng
S	=	sample volume or mass (in L or Kg) extracted or purged

12.1.3 Calculated values for spiked samples, duplicate analyses, and reference standards are compared with quality control limits to determine data validity. Recovery of any spiked analyte (including surrogate compounds) is calculated as:

$$\%\text{Recovery}\ \frac{C_s - C_u}{C_n}\ \text{X}\ 100$$

Where:

C_s = measured concentration of the analyte or surrogate
C_u = concentration of the unspiked sample (for LCS and surrogate recoveries $C_u = 0$)
C_n = true value or known concentration of the analyte or surrogate

12.1.4 The precision of duplicate analyses is determined from the relative percent difference (RPD) calculated by:

$$RPD = \frac{Abs\,(R_1 - R_2) \bullet 2}{R_1 + R_2} \times 100$$

Where:

Abs = Absolute value
R_1 = measured concentration of first replicate
R_2 = measured concentration of second replicate

12.1.5 Relative Standard Deviation (RSD) is computed from the standard deviation and mean recovery when the standard deviation is derived from multiple recovery results:

$$RSD = \frac{\text{Standard Deviation (s)}}{\text{Mean Recovery}} \times 100$$

12.1.6 If results are not within acceptance limits, the analysis data is fully reviewed to determine if sample contamination or matrix problems exist. If there is still a problem with the quality of the data, in-depth investigation into the method in question is conducted until the problem is solved. (see Section 13, Corrective Action)

12.1.7 Procedures for manual integration are incorporated by reference to the Manual Integration SOP (CP01-3).

12.2 Corrections

Entries in records shall not be obliterated by methods such as erasures, liquid paper, overwritten files or other markings. All corrections to record-keeping errors shall be made by one line marked through the error. The individual making the correction shall sign (or initial) and date the correction. These criteria shall also apply to electronically maintained records.

12.3 Logbook Use Guidelines

12.3.1 Use permanent ink. No pencils may be used.

12.3.2 Corrections: Use a single line to cross out documentation. Date and initial cross-out. If the reason for the cross out is un-clear. A notation must be recorded clarifying the correction.

12.3.3 Blank pages or space between the last entry and the bottom of page must be "Z'"d through, initialed and dated.

12.3.4 Data must be entered directly and consecutively into the notebook. It is not to be placed onto scratch paper and entered later.

12.3.5 Entries added to previously signed pages must be dated, initialed and witnessed (if appropriate) below the new material.

12.3.6 Sign and date all pages upon completion.

12.3.7 When pages are added to the notebook, they must be signed and dated across both the added page and the notebook page.

12.4 Spreadsheet Use Guidelines

A qualified individual who is independent of the development of the spread sheet conducts validation of the spreadsheet. The procedure used to validate spreadsheets is as follows:

12.4.1 Verification of formulas used in the spreadsheet by visual inspection.

12.4.2 Side by side analysis of real data to validate the spreadsheet is functioning properly.

12.4.3 When the spreadsheet is brought on-line. The analysis of 4 Laboratory control samples (Section 8.3.1) for a demonstration of capability.

12.5 Data Verification

Data verification or review is the routine laboratory process through which proper quantification, recording, transcription, and calculations are confirmed. It also confirms that the data is reasonable and complete. The process should be such that errors are minimized and that corrective action steps are taken when errors are detected. The data verification process includes two steps: primary (initial) and secondary review.

12.5.1 Primary (Initial) Review

12.5.1.1 The analyst performs the initial review of the data. The analyst is responsible for verifying the correctness of the data entered into the Laboratory Information Management System (LIMS). This review includes, but is not limited to, verifying that quality control indicators (QCI) meet protocol criteria, calibration criteria are met, appropriate detection limits were used and data was reduced correctly. The analyst must perform primary review on 100% of the data generated.

12.5.1.2 Control limits for applicable quality control indicators (e.g., Continuing Calibration Verfication (CCV), Laboratory Control Standards (LCS), Matrix Spike/Matrix Spike Duplicate (MS/MSD)) are established in the LIMS. If an analyst enters quality control data for an analytical batch that is outside the control limits, the LIMS produces a message to the analyst, regarding a choice on whether or not to continue with data entry. If the out-of-control data is entered into LIMS, the data then has one or more FLAGS associated with it that shows up on approval reports and on the final report to the client.

12.5.2 Secondary Review

A person other than the analyst generating the data can be responsible for a secondary review of the data. The project coordinators or operations managers are responsible for the secondary review. A data review system is used for secondary review in accordance with SOP CF07-04, CF07-05, and CF07-06. This step is intended as a verification of the primary review. Secondary review focuses on calibration criteria, quality control criteria, compound identification, results expression, reporting limits, and levels of documentation. Approximately 10% of the data is verified. If problems are observed during this review, the data is returned and a 100% review is done and corrective action is performed as appropriate. Correlation of results for different but related analysis may be used to check for the correctness of data (e.g. BOD should be approximately 30-70% of a COD, cBOD should be equal to or less than the BOD, etc).

12.5.3 Final Review

Project Managers or Project Coordinators review the report to ensure that all of the project requirements have been met, including QA reportables. The report contains all the necessary flag documentation, COC, and Sample Receipt and Temperature Log documentation. Ensure that a case narrative or cover letter is provided if necessary. The Project Managers or Project Coordinators approve the final report for release to the client by signing the report.

12.5.4 Correlation of results for different but related analysis of samples may be performed by LIMS system or project manager prior to transmission of reports. Examples of these correlations can be found below in Table 12-1. Sample results that fail these correlations will be re-evaluated by the analyst or other designated personnel.

<u>Table 12-1 LIMS Correlation Formulas</u>

Total Chromium >= Hexavalent Chromium
Total Metals > Dissolved Metals
Total Metals > TCLP Metals
Total Dissolved Solids between 0.55 and 0.90 * Conductivity
Total Solids >= Total Dissolved Solids
Total Solids >= Total Suspended Solids
Total Suspended Solids >= Volatile Suspended Solids
Total Kjedhal Nitrogen >= Ammonia Nitrogen
Organic Nitrogen = TKN – NH3
Total Phosphorus > Ortho Phosphorus
Biological Demand > Total Organic Carbon
Chemical Oxygen Demand > Total Organic Carbon
COD 30 – 70 % > BOD
Total Sulfide >= Reactive Sulfide
Total Cyanide >= Amenable Cyanide
Oil & Grease >= Hydrocarbon Oil & Grease
Total Phosphorus >= Dissolved Phosphorus
Total Alkalinity >= Bicarbonate Alkalinity
Total Alkalinity >= Carbonate Alkalinity

12.5.5 Data found to be of doubtful quality by the analyst, through internal audits or arising from customer concerns must be reviewed by a member of laboratory management using the procedures outlined in Section 13.

Figure 12-1 is a flow chart for the generation of data. After verification of the data is complete, the results are printed from the LIMS into a final report for transmittal to the client.

12.6 Data Reporting

Analytical results are issued in a format that is intended to satisfy customer requirements. A variety of report formats are available to meet specific needs. The Analytical Report will be printed on laboratory stationary, reviewed, and signed by a designated person. Persons designated to sign reports include:, Laboratory Director; Operations Managers; Project Coordinators and Quality Assurance Officer.

12.6.1 Required Report Format and Contents

An example report can be found in Figure 12-2. At a minimum, the following information must be included in all reports:

12.6.1.1 A title;
12.6.1.2 Name and address of laboratory and phone number and a contact name for questions;
12.6.1.3 Unique identification of the report, Name and address of client and project name if applicable.
12.6.1.4 Description and unambiguous identification of the tested sample including the client identification code.
12.6.1.5 Identification of test results derived from any sample that did not meet NELAC or other regulatory requirements for sample acceptance such as improper container, holding time, or preservation.
12.6.1.6 Date of receipt of sample, date and time of sample collection (if available), sample prep/analysis time (if hold time is less than or equal to 72 hours) date(s) of test performance.
12.6.1.7 Identification of the test method used, or an unambiguous description of any non-standard method used.
12.6.1.8 If the laboratory collected the sample, reference to sampling procedure.
12.6.1.9 Any deviations from the test method, such as failed QC, additions to or exclusions from the test method, and any non-standard conditions that may have affected the quality of results are identified. Include the use and definitions of any data qualifiers. An example list of typical data qualifiers (reporting flags) used by the laboratory can be found in Table 12-3.
12.6.1.10 Measurements, examinations and derived results. Identify whether data are calculated on a dry weight or wet weight basis. Identify the reporting units. Numerical results with values outside of the quantitation levels are identified as having less certainty.
12.6.1.11 Total number of pages
12.6.1.12 A signature or electronic identification of the person(s) accepting responsibility for

the content of the report and date of issue.

12.6.1.13 Clear identification of all test data provided by a subcontracted laboratory. The sub-contractor name or accreditation number (if available) must be identified on the report.

12.6.1.14 If client request's, a statement on the estimated uncertainty of the measurement (See Section 11.5).

12.6.2 TestAmerica Analytical Testing Corp – Cedar Falls, IA offers four (4) levels of quality control reporting. Each level, in addition to its own specific requirements, contains all the information provided in the preceding level. The packages provide the following information in addition to the information described above:

12.6.2.1 Level I-Client name and address, Sample date, Sample description, TestAmerica Analytical Testing Corp - Cedar Falls Division sample number, Type of analysis performed, analytical result, date analysis performed, analytical method, analyst initials, surrogate results, Chain of Custody(COC).

12.6.2.2 Level II- Should at least include All documentation included in Level 1 plus, blank, LCS, and precision/accuracy information (MS/MSD/duplicates), Continuing calibration verification (CCV) data.

12.6.2.3 Level III- All documentation included in Levels I & II plus, Case narrative and CCV results for GC/MS.

12.6.2.4 Level IV- Should provide all information described in Levels I, II and III above in addition to Blank report, Initial Calibration Verification Standard results for all analytes, Tune Report (GC/MS), Internal Standard Report (GC/MS) and all sample raw data.

In addition to the various levels of QC packaging, the laboratory also provides reports in electronic diskette deliverable (EDD) form. Initial reports may be provided to clients by facsimile. All faxed reports are followed by hardcopy. Procedures used to ensure client confidentiality are outlined in Section 12.6.4.

12.6.3 Customer reports can be mailed, faxed, or transmitted by email in a portable document format (PDF).

12.6.3.1 Laboratory personal are instructed to only transmit client reports to a location specified on the chain of custody or unless an alternate recipitant is requested prior to commencement of work.

12.6.3.2 The chain of custody fields that are applicable to this procedure are:

(a) Client mailing address
(b) Client Fax Number
(c) Client Email Address
(d) Other information recorded on the Chain of Custody

12.6.4 Corrected reports

Occasionally a report must be corrected due to the addition of a test or the correction of an error. When the report is corrected, a notation of "Amended Report" and the date and initials of the individual who amended the report is to be placed on top of the page in the report. A brief explanation of the correction may be required. If it is not practical to include this information directly on the corrected page, a "text" flag can be placed in the flag column of the report and a case narrative containing the explanation can be included with the report.

All corrections that are due to a data entry errors must be evaluated and documented according to the policies listed in TestAmerica Analytical Testing Corp SOP CP01-06 (Internal Investigation of Potential Data Discrepancies and Determination for Data Recall).

12.6.5 Confidentiality and Proprietary Rights

TestAmerica Analytical Testing Corp Incorporated will not intentionally divulge to any person (other than the Client or any other person designated by the Client in writing) any information regarding the services provided by TestAmerica Analytical Testing Corp or any information disclosed to TestAmerica Analytical Testing Corp by the Client. Report deliverable formats are discussed with each new client. If a client requests that reports be faxed, the reports are faxed with a cover sheet that includes a confidentiality statement similar to the following:

This material is intended only for the use of the individual(s) or entity to whom it is addressed, and may contain information that is privileged and confidential. If you are not the intended recipient, or the employee or agent responsible for delivering this material to the intended recipient, you are hereby notified that any dissemination, distribution or copying of this communication is strictly prohibited. If you have received this communication in error, please notify us immediately by telephone at the number above.

This shall not apply to the extent that the information is required to be disclosed by TestAmerica Analytical Testing Corp under the compulsion of legal process. TestAmerica Analytical Testing Corp will, to the extent feasible, provide reasonable notice to the client before disclosing the information.

Note: Authorized representatives of an accrediting authority are authorized to make copies of any analyses or records relevant to the accreditation process and copies may be removed from the laboratory for purposes of assessment.

12.6.6 Signification Figures and Rounding Convention

Rounding conventions for organics, metals and wet chemistry are listed below in Table 12-3. In the case of direct downloading from a data system to LABSYS, the number of significant figures reported from LABSYS is determined by the number of significant figures in the default result. If the default result has 2 significant figures then the result reported from the data system will be rounded to 2 significant figures, regardless of the number of significant figures reported by the data system.

Table 12-2 Significant Figures Rounding Convention

	Rounding Convention	
Value	**Organics**	**Inorganics**
<1	0.X	0.XXX or 0.XX
<10	X.X	X.X
<100	XX.X	XX.
<1,000	XXX.0	XX0.
<10,000	X,XX0	X,X00
<100,000	XX,X00	XX,000

X = any number between 0 and 9

12.6.6.1 Rounding Procedure

a) If the digit previous to the significant figure is > 5, then the significant figure is increased by 1.
b) If the digit previous to the significant figure is < 5, then the significant figure is not increased.
c) If the digit previous to the significant figure is 5 and the significant figure is even (0, 2, 4, 6, 8) is not increased.
d) If the digit previous to the significant figure is 5 and the significant figure is odd (1, 3, 5, 7, 9) is increased by 1.

12.7 Data Storage

12.7.1 Records Management

The following records are maintained for a minimum of 7 years:

12.7.1.1 Correspondence between laboratory and client (including communication logs).
12.7.1.2 Field records of sampling events.
12.7.1.3 Original raw analytical data. This includes, but is not limited to, logbooks, hard copies of chromatograms, computer data printouts of calibration standards, QC samples, analytical samples, MDLs, control limits, standard preparation, method reference and data review records.
12.7.1.4 Copies of final reports including analytical results, log sheets, chain of custody, shipping receipts and where required, copies of the raw data.
12.7.1.5 Quality Assurance records including, but not limited to, archived SOPs, corrective action reports, internal and external audits and responses, Performance Testing sample results and raw data, and employee training records.
12.7.1.6 Business information, including invoices and records pertaining to suppliers.
12.7.1.7 Electronic Records, including tape back-up drives, compact disc (CD), and floppy disks.

12.7.2 Record Storage

Hard copies of these records are stored and filed numerically, alphabetically, or chronologically by date or batch as appropriate for the type of record. Periodically all records are transferred to storage boxes which are labeled with the month(s) and year(s) in which the records were generated. Each box is given a unique number and entered into an archive log (Figure 12-3) that includes a description of the contents of each box, dates that the contents cover, and the location that the box is stored in. A copy of this description of the contents is written to the outside of the box. The archived boxes are stored on-site temporarily and then transferred to an off-site storage facility. Boxes are stored in such a way to allow easy retrieval of records upon request. Requests for the retrieval of archived information are directed towards the QAO. These requests for archived information are logged into the Archive Removal Log (Figure 12-4). Quantitation reports generated on chromatographic data system and metals ICP data systems are archived on CD-ROM.

Archive areas are protected against fire, theft, environmental deterioration, and vermin. Archive areas are regularly inspected as part of the Internal Audit Program. Representatives of an accrediting authority may have access to archived information.

In the event that the laboratory transfers ownership, the new proprietors retain sole custody and responsibility for all records. If the laboratory closes, records are maintained at a commercial archive facility or are maintained by another laboratory within the network. In some cases, records may also be transferred back to the client if requested.

12.7.3 Analytical Logbooks

A log is kept of all notebooks (e.g. standard logbooks, instrument logbooks) that are issued. At a minimum, this log includes:

12.7.3.1 Issuance of Logbooks

(a) Notebook Number. Each notebook is issued a unique number that is determined sequentially.
(b) Used For. Purpose and department of notebook.
(c) Replaces Notebook Number. Place the number of the notebook that the issued notebook will replace if applicable.
(d) Date of Issue. This is the date that the notebook is released.
(e) Archive.
    1) All notebooks are archived when they are complete and no longer in use. They are turned into the QA Department for archiving.
    2) The date and initials of the person who placed the notebook in the box for archiving.
    3) The box number that the notebook is archived in.

An example notebook issuance log can be found in Figure 12-5.

Figure 12-1 Analytical Data Review and Reporting Scheme

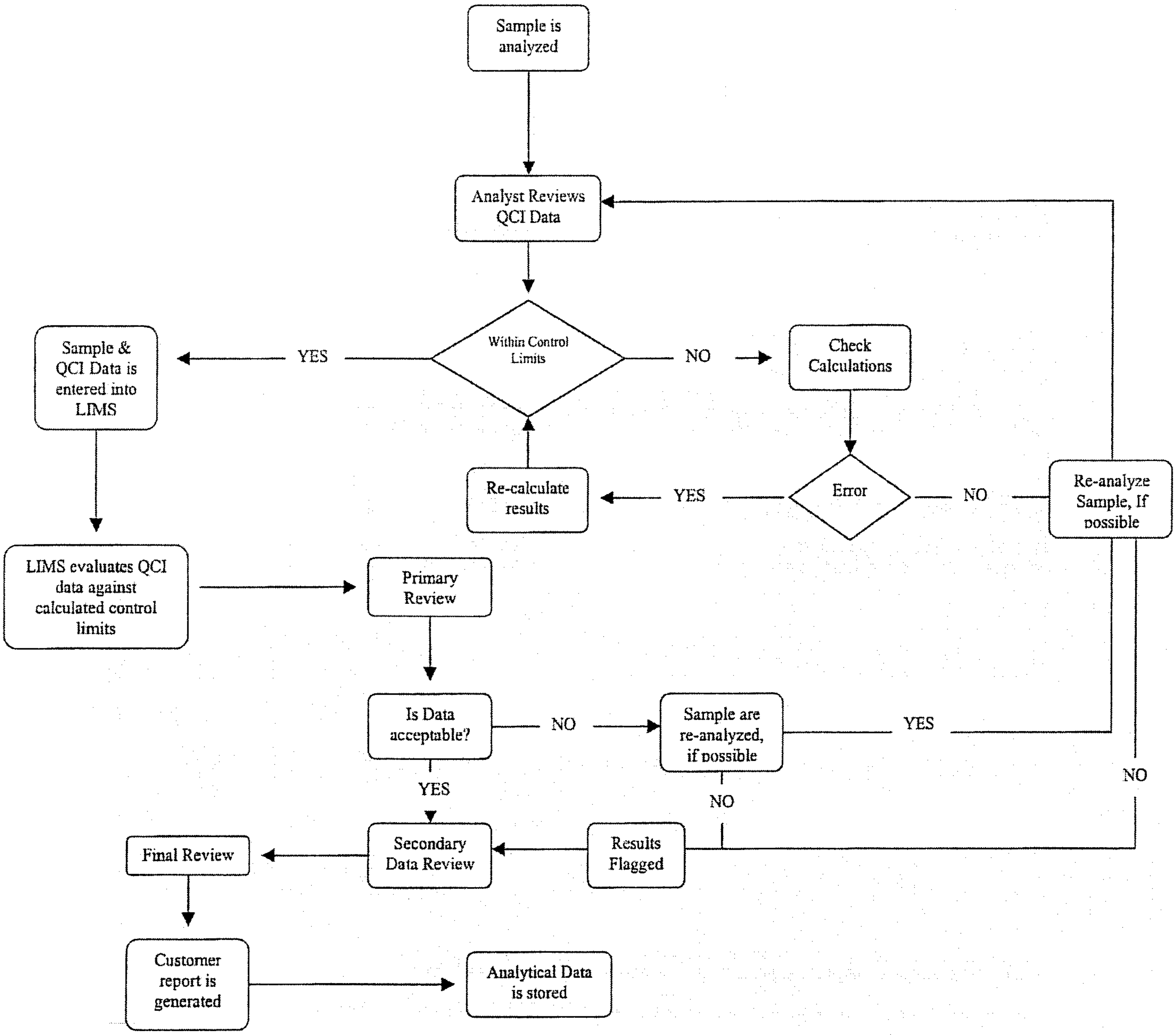


Figure 12-2: Example Report Format

TestAmerica
ANALYTICAL TESTING CORPORATION

704 Enterprise Drive • Cedar Falls, IA 50613 • 319-277-2401 • Fax 319-277-2425 • 800-750-2401

ANALYTICAL REPORT

Client
Information

04/13/2005

TestAmerica Job: XX.XXXXX

Project Number: Client Project Number
Project: Client Project ID

Enclosed is the Analytical Reports for the following samples submitted to the Cedar Falls Division of TestAmerica Analytical Testing Corporation for analysis.

Sample Number	Sample Description	Date Taken	Date Received
XXXXXX	Client Sample ID	04/06/2005	04/07/2005
XXXXXX	Client Sample ID	04/06/2005	04/07/2005

TestAmerica Analytical Testing Corporation certifies that the analytical results contained herein apply only to the specific samples analyzed.

Reproduction of this analytical report is permitted only in its entirety.

Approval Signature

Kristin Clay
Inorganics Operation Manager

Figure 12-2: Example Report Format (Con't)

TestAmerica
ANALYTICAL TESTING CORPORATION

Page 2 of 3

704 Enterprise Drive • Cedar Falls, IA 50613 • 319-277-2401 • Fax 319-277-2425 • 800-750-2401

ANALYTICAL REPORT

Client
Information

04/13/2005

Date Received: 04/07/2005
Job Number: XX.XXXXX

	Result	Units	Flags	Date Taken	Date Analyzed	Time Analyzed	Analyst	Analysis Method
858237 Client Sample ID								
CBOD - Five Day	150	mg/L	CDEP	04/06/2005	04/07/2005	14:20	lms	SM-5210 B
Solids, Suspended	110	mg/L		04/06/2005	04/07/2005		lbb	USGS I-3765-85
858238 Client Sample ID								
CBOD - Five Day	13	mg/L	CDEP	04/06/2005	04/07/2005	14:20	lms	SM-5210 B
Solids, Suspended	25.0	mg/L		04/06/2005	04/07/2005		lbb	USGS I-3765-85

Key to Flags:
CDEP - Depletion for cBOD blanks is over 0.2 mg/L.

Figure 12-2: Example Report Format (Con't)

TestAmerica
ANALYTICAL TESTING CORPORATION

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TestAmerica Job Number: XX.XXXXX

ATTACHMENTS

Following are the sample receipt log and the chain of custody applicable to this analytical report.

Any abnormalities or departures from sample acceptance policy shall be documented on the "Sample Receipt and Temperature Log Form" and Sample Non-Conformance Form" (if applicable) included with this report.

For information concerning certifications of this facility or another TestAmerica facility please visit our website at **www.TestAmericaInc.com**.

This data has been produced in compliance with 2003 NELAC Standards (July 2005), except where noted.

Samples collected by TestAmerica Field Services personnel are noted on the Chain of Custody (COC) and are sampled in accordance with TA-CF SOP CF09-01.

This report shall not be reproduced, except in full, without written approval of the laboratory.

For questions regarding this report, please contact the individual who signed the analytical report.

Figure 12-3: Archive Log

Archive Logbook

Box No.	Date Archived /Initials	Description of Contents	Location (Shed No.)	Date Moved and Shed # of off site storage
CF-05-14	3/11/05 AM	Volatiles 2/4/05 - 2/9/05 R7314 - R7401 X7799 - X7846 C4807 - C4927 F0281 - F0354	4	
CF-05-15	3/11/05 Am	PCB TUN 11/11/04 - 11/24/04 Indiana 9/10/04 - 1/28/05	4	
CF-05-16	3/11/05 AM	Extractables 1/4/05 - 2/14/05	4	
CF-05-17	3/23/05 Am	HPLC Files 1/25/05 - 2/16/05		
CF-05-18	3/23/05 AM	Extractables WRB 4869 - 4693 / SRB 5538 - 1/10/05 - 2/2/05 5566		
CF-05-19	3/24/05 AM	Cinnamon + Shamp 1/28/05 - 2/15/05		
CF-05-20	3/24/05 AM	Volatiles 2/9/05 - 2/14/05 X7847 - X8025 R7430 - R7449 C4880 C5051 F0356 - F0429		
CF-05-21	3/24/05 Am	Volatiles 2/14/05 - 2/16/05 X8027 - 8088 F0433 - F0556 C5056 - C5172 R7459 - R7522 A1945 - A1947		
CF-05-22	3/24/05 AM	Volatiles 2/16/05 - 2/18/05 C5124 - C5270 X8090 - X8160 F0558 - F0653 A1972 - A1991 R7530 - R7589		
CF-05-23	3/24/05 AM	Volatiles 2/23/05 - 2/24/05 X8275 - 8344 F0735 - F0883 A2099 - A2173 R7621 - R7688 C5322 - C5339		
CF-05-24	3/24/05 AM	BNAS 2/11/05 - 3/4/05 P691 - P999 J0306 - J0439		
CF-05-25	3/24/05 AM	Volatiles 2/18/05 - 2/23/05 X8162 - X8321 R7402 - R7614 A1999 - A2088 F0685 - F0733		
CF-05-26	3/30/05 AM	Volatiles 3/4/05 - 3/11/05 F1098 - F1203 X8491 - X8629 R7779 - R7822 A2274 - A2374 C5356 - C5402		

Figure 12-4: Archive Removal Log

Archive Removal Log

Date Requested	Box #	Book/File #	Shed #	Person(s)	Date Returned
11/01/04	12 2003 Reports	Environmental Protection 2003	2	For JP/N	
11/01/04	46 2003 Reports	Trissel Grain & Tool Inc 03.11405	2	For 86/N	
2-02-05	3 2004 Reports	RDG [illegible]	2	For NF/Am	
2-7-05	CF 216-4 & CF-4-217	12/21/04 C3502 465533, C3584	4	For DK/Am	2-8-05
2-7-05	HPLC 887 RB 083884 885	CF-4-223	4	for DK/Am	2-8-05
2-8-05	BOA Curve J9D4B	CF-4-207	4	For DK/AM	2-9-05
2-9-05	Arsenic Cadmium	CF-4-203	4	For DK/Am	2-11-05
2-9-05	Lead	CF 4-205	4	For DK/Am	2-11-05
2-14-05	[illegible] R9355-9359	CF-04-60	5	For DK/AM	2-14-05
2-14-05	R 9315-9336 R4021-4042	CF-04-154	5	For DK/AM	2-14-05
2-17-05	Seneca Bettendorf 04.09331, 04.19	05 + 04.0281	2	For JP/Am	
2-18-05	MWH Chicago #2	MWH	2	For DK/AM	2-22-05
2-18-05	Orange Back Curve	CF4-180	3	for Am	
2-18-05	Green Front Curve	CF-4-169	5	For Am	
2-22-05	Wet Chem Book CF-1045	CF-1045	3	For LC/Am	2-22-05
3/22/05	Logbook CF-0921	CF-03190	3	For LC/AM	3-22-05
3/23/05	RDG Report (NW)	2004 Reports 4-37	2	FOR RB/AM	

Page: 11

Figure 12-5: Log for Issuance of Logbooks

Log Book of LogBooks

Notebook Number	Use and/or Location	Replaces Notebook Number	Date of Issue / Initials	Archived	
				Date & Initials	Box No.
CF-1243	Ext HC injection logbook	CF-1191	3/1/05 AM		
CF-1244	Process Evaluation Records	—	3/4/05 AM	3/4/05 AM	CF04-221
CF-1245	Mercury Prep/Analysis Logbook	CF-1186	3/11/05 AM		
CF-1246	Total Suspended Solids	CF-1189	3/16/05 AM		
CF-1247	Cinnamon Injection Log	CF-1170	3/16/05 AM		
CF-1248	Homer GC/MS Inj. Log	CF 1146	3/17/05 AM		
CF-1249	pH Volatiles 3/22/05 - 3/22/05	—	3/22/05 AM	3/22/05 AM	CF-04-221
CF-1250	pH	CF-1201	3/24/05 AM		
CF-1251	Metals Prep Log Water/AH	CF-1204	3/25/05 AM		
CF-1252	Total Dissolved Solids	CF-1152	3/29/05 AM		
CF-1253	TIBERIUS RUN LOG	NEW ISSUE	4/1/05 mey		
CF-1254	MARIGOLD RUN LOG	NEW ISSUE	4/1/05 mey		
CF-1255	TCLP/SPLP PREP BOOK	CF-1167	4/1/05 mey		
CF-1256	PCB Prep Logs	CF-1161	4/5/05 AM		
CF-1257	pH Volatiles 3/23/05 - 4/08/05	—	4/8/05 AM		
CF-1258	Total Phosphates	CF-0991	4/12/05 AM		
CF-1259	BOD/CBOD	CF-1237	4/12/05 AM		
CF-1260	Cadmium Red Nitrates	CF-1126	4/14/05 AM		
CF-1261	TOTAL HARDNESS	CF-0805	4/15/05 mey		
CF-1262					
CF-1263					
CF-1264					
CF-1265					
CF-1266					
CF-1267					
CF-1268					
CF-1269					
CF-1270					
CF-1271					

Page: 7

Table 12-3: Report Flags

FLAG	DESCRIPTION	CUSTOMER REPORT MESSAGE
*	SAMPLE CONC. > 4X SPIKE CONC.	* - Sample concentration is greater than four times the spike concentration
+	R of MSA is less than 0.995	+ - the correlation coefficient of MSA for this analyte is less than 0.995
10	10X dilution	10 - Analyzed at a 10X dilution
100	100x Dilutiion	100 - Analyzed at a 100X dilution
2	2X Dilution	2 - Analyzed at a 2X dilution
20	20X dilution	20 - Analyzed at a 20X dilution
200	200X dilution	200 - Analyzed at a 200x dilution
5	5X dilution	5 - Analyzed at a 5X dilution
50	50X dilution	50 - Analyzed at a 50X dilution
500	500X dilution	500 - Analyzed at a 500X dilution
<	LESS THAN	< LESS THAN
<12	Sample received at pH<12.	<12 - Sample received at pH<12. It was adjusted correctly prior to analysis.
>2	Sample received at pH>2	>2 - Sample received at pH>2. It was adjusted correctly prior to analysis.
ACT	Subbed to Aquatic Consulting	ACT - Analysis subcontracted to Aquatic Consulting & Testing, Inc.
AL	Subbed to Analytical Laboratories	AL - Analysis subcontracted to Analytical Laboratories
AM	Asbestos found in mastic	AM - Asbestos found only in mastic.
AND	Asbestos <1%	AND - Trace amount of asbestos found in sample.
AQ	Subbed to Aquatic Consulting	Analysis subcontracted to Aquatic Consulting & Testing Inc. of Tempe, Arizona.
ARI	ARI - Subbed to ARI	ARI - Analyis subcontracted to Analytical Resources Incorporated.
AS	Asbestos in soil	AS - Sample matrix causes highly variable results.
AT	Asbestos found in only in tile	AT - Asbestos found only in tile.
ATM	Asbestos in mastic & tile	ATM - Asbestos found in mastic and in tile.
B	ANALYTE FOUND IN BLANK	B - This analyte was detected in the method blank.
BA	Subbed to Bartlett	BA - Analyzed by TestAmerica East Dundee, Illinois customer support center.
BH	Form. impinger back is more than fr	Back impinger conc. is greater than front impinger conc. by 33% or more.

FLAG	DESCRIPTION	CUSTOMER REPORT MESSAGE
BMS	Blank MS/MSD Assigned to Sample	BMS - Blank MS/MSD Assigned to a sample
BT	Breakthrough to 2nd section is > 10	BT - Sample breakthrough to 2nd section is > 10%. Results may be biased low.
C	Calibration out of control	C = Calibration outside of control criteria.
CCV	CCV outside of control limits.	CCV-Continuing calibration standard is outside of method control limits.
CDEP	CBOD depletion over 0.2 mg/L.	CDEP - Depletion for cBOD blanks is over 0.2 mg/L.
CH	Subbed to Chicago	Analysis subcontracted to TestAmerica Chicago Division.
CL	Subbed to Clarkson Laboratory	CL - Analysis subcontracted to Clarkson Laboratory & Supply Inc. of Chula Vista, Ca.
CLS	Clayton Lab Services	Analysis Performed by Clayton Laboratory Services.
DEP	BOD over 0.2 mg/L	DEP - Depletion for BOD blanks is over 0.2 mg/L.
DO	Diluted Out	DO -Diluted Out
DP	BOD calculated with <2.0 depletion	DP - BOD is calculated using less than 2.0 mg/L depletion of oxygen.
DT	Subbed to Dayton	DT - Analysis subcontracted to TestAmerica - Dayton Division
Dry	results in dry weight	Dry - Results are reported on a dry weight basis.
E	Estimated concentration	E - Estimated concentration for this analyte
ECCS	Analyses sub-contracted to ECCS	Analyses sub-contracted to Environmental Chemistry Consulting Services, Inc. (ECCS)
EH	Estimated due to head space	EH - Estimated result for this analyte due to head space in vial.
EI	Subbed to Environmental Inc.	EI - Analysis subcontracted to Environmental Inc. Laboratory in Northbrook, Illinois.
ET	endpoint time out message on TOC	ET - Matrix interference in sample is causing an endpoint timeout.
F	F - Ran by ECCS	F - Analysis performed by ECCS - Madison, WI
FL	Flashpoint <140.	FL - This result is <140 degrees Celsius. This sample may be considered hazardous.
FM	High D.L.'s Due To Foaming	FM - High detection limits due to sample foaming
G	RSD > 15%	G - %RSD greater than 15%, uncertainty may be increased
H	SAMPLE ANALYZED PAST HOLDING TIME	H - Sample analyzed past holding time
HI	Visible Hydrocarbons	HI - Reporting limit elevated due to hydrocarbon interference.
I	Internal Std Out	I - Internal Standard outside of QC limits due to sample matrix.
IC	Improper Container	IC - Sample received in improper container for this analysis.

FLAG	DESCRIPTION	CUSTOMER REPORT MESSAGE
ICV	ICV - ICV out of control limits	ICV - ICV is out of control limits for this analyte.
IE	ICP - interelement	IE - Elevated Reporting Limit due to interelement interference.
IM	Results biased/improper matrix	Results may be biased due to sample matrix.
IN	Subbed to Indy	IN - Analysis subcontracted to TestAmerica Indianapolis
IO	Analyzed medium level soil	IO - Methanol extract analyzed due to low level method interferences.
IP	Improperly Preserved	IP - Improperly preserved sample for this analyte.
IS	High D.L's Due To Insufficient Samp	IS - High detection limits due to small sample volume either used in analysis or available.
J	DETECTED ABOVE MDL BUT BELOW PQL	J - Measured concentration was below the PQL and above the MDL.
L	LCS OUT OF CONTROL	L - LCS recovery is outside of control limits.
LA	Lab Accident	LA - Unable to analyze for this parameter due to laboratory accident.
LC	LCS DUP OUT OF CONTROL	LC - LCS/LCSD relative percent difference is out of control.
LCA	LabCorp Analytics Division	Analysis Performed by LabCorp Analytics Division.
LN	LCS not analyzed	The Laboratory Control Standard was not analyzed for this analytical batch.
M	DUPLICATE RPD > Limits	M - Duplicate (or MS/MSD) RPD is outside of control limits.
MM	Acid concentration not matched	MM - Samples & Standards not matrix matched. 8% HNO3 used for standards.
MSO	MS AND/OR MSD OUT OF CONTROL	MSO - MS and/or MSD recoveries are outside of control limits
N	SPIKE OUT OF CONTROL	N - Spike recovery for this analyte is outside of method control limits.
NA	Any analyte not run due to matrix	NA - Unable to determine due to matrix or consistency of sample
NC	Subbed to North Coast Labs	NC - Analysis subcontracted to North Coast Laboratory
NT	Non Target Compound(s) Found	NT - Non-Target compound(s) found in this sample
NTB	Any sample received in incorrect.	NTB - Sample received in incorrect container for this analysis.
OL	High D.L.'s Because Sample is Oily	OL - High detection limits due to oil in the sample.
OOC	Surrogate OOC	OOC - Surrogate recovery outside QC limits due to matrix interferences.
OR	Subbed to Orlando	OR - Analysis subcontracted to TestAmerica Orlando Division.
PH	Sample received at improper pH	PH - Sample received at improper pH for this parameter. Adjusted correctly prior to analysis.
PS	Post digestion spike	PS - The spike analyzed for this metal is a post-digestion spike.

FLAG	DESCRIPTION	CUSTOMER REPORT MESSAGE
PT	Analyzed at Pontiac, Michigan	PT - Analysis subcontract to TestAmerica Pontiac, Michigan.
R	RL raised due to matrix interfernce	R - Reporting limit elevated due to matrix interferences
RH	Received past hold time	RH - Received at lab past the holding time for this analyte
RV	RL raised due to RLVS being out	RV - Reporting limit elevated due to reporting limit verificationstandard being outside of control limits.
S	Reported value determined by MSA	S - Reported value determined by the method of standard addtions
SA	Subbed to Nashville	SA - Analysis subcontracted to TestAmerica Nashville Division
SO	Estimated results due to HT	Result is estimate due to exceedance of 1 hour holding time.
ST	Subbed to Servi-Tech	ST - Analysis subcontracted to Servi-Tech Laboratory
TE	Temp. exeeds method range	TE - Temperature during TCLP extraction exceeds method range
TO	Subbed to Texas Oil Tech	TO - Analysis subcontracted to Texas Oil Tech Labs
TT	time taken not availble	TT - Time taken not available, unable to determine if within holding time.
Ti	Subbed to Eno River Labs	Ti - Analysis performed by Eno River Labs in Durham, NC
U	NOT DETECTED (LESS THAN)	U - Analyte not detected above the reporting limit
U2	Unable to prep full amount	U2 - Unable to extract full sample volume due to matrix
UD	digestion problem	UD - Unable to digest full amount of sample due to matrix problem.
W	Post digestion spike is out of CL	W - Post digestion spike is out of control limits for this analyte
WAL	Subbed to Wyoming Analytical Labs	WAL - Analysis subcontracted to Wyoming Analytical Labs.
WET	Charcoal tube received wet.	WET - Sample was received by the laboratory with moisture in the charcoal tube. Sample results may be biased low.
WOHL	Wisc. Occup. Health Lab	Analysis by Wisconsin Occupational Health Laboratory.
WT	Subbed to Watertown	WT - Analysis subcontracted to TestAmerica-Watertown. IA Cert. #294
Wet	results in wet weight	Wet - Results are reported on a wet weight basis.
X	OA-2 Chromatography Does not match	X = Does not match OA-2 standards. Quantified using Diesel response factor.
Z	Lab contaminate	Z - Common lab solvent, result may be from contamination.
b+	bacterial growth present - no total	b+ - Bacterial growth present but does not confirm as Total Coliform.
bod	bod out of method	bod - Depletion for BOD falls out of the method criteria.
cf	centrifuged to remove solids	cf - Results may be biased low due to centrifuging to remove solids.

FLAG	DESCRIPTION	CUSTOMER REPORT MESSAGE
ch	High Chlorine	ch - Sample had high Chlorine. It was dechlorinated prior to analysis.
cl	Closing CCV out due to matrix	cl - Closing CCV out of control due to interference from previous sample.
conf	bacterial results confirmed	Conf - Confirmation of positive results performed.
ehl	Subbed to Environmental Health	ehl - Analysis subcontracted to Environmental Health Laboratories.
em	Subbed to EMSL	em - Analysis subcontracted to EMSL Analytical Inc.
emsl	Subbed to emsl	emsl - Analysis subcontracted to EMSL analytical.
ff	Fineness factor by Servi-Tech	ff - The fineness factor used to calculate the ECCE was determined by Servi-Tech Laboratories.
fl	Solids floated	fl - Solids did not settle to bottom but floated.
he	estimated result due to head space	This result estimated due to head space in vial.
is	Insufficient sample available	is - Reporting limit raised due to insufficient sample volume.
j	Below loq	j - Result is below PQL but above the method detection limit.
k	Atypical Chromatography	k - Poor chromatographic match to standard
lib	Library Search	lib - Estimated results are based upon a library search.
lin	Linear regression	Linear regression calibration used to quantitate results.
mdl	result calculated from MDL	mdl - Results calculated/entered to the method detection limit.
p	Surrogate out for extractables	p - Surrogate recovery limits not applicable. Oil interference.
pco	Probable carry over hit	pco - Probable carry-over from an earlier run
sca	Sample Concentrated for Analysis	sca - Sample concentrated for analysis for this analyte
uhl	Analyzed at UHL	uhl - Analysis subcontracted to University of Iowa Hygienic Laboratory - Iowa Cert. #027
upH	Unable to adjust pH	upH - Sample unable to be adjusted to correct pH due to matrix.

Section 13.0
Corrective Action

An important part of any quality assurance program is a well-defined, effective policy for correcting quality problems. TestAmerica Analytical Testing Corp maintains a corrective action system that operates under the direction of the Division Manager and Quality Assurance Officer. While the entire quality assurance program is designed to avoid problems, it also serves to identify and correct those that occur. Usually these quality problems fall into two categories: immediate corrective action or long-term corrective action.

13.1 Immediate Corrective Action

Specific quality control procedures are designed to help analysts detect the need for corrective action. Often, an analyst's experience will be most valuable in identifying abnormal analyses or malfunctioning equipment; immediate corrective action then may be taken. Such actions should be noted in laboratory notebooks but no other formal documentation is required unless the corrective action taken fails to correct the problem.

13.2 Long Term Corrective Action

The need for formal corrective action may be identified by performance on routine QC samples, control chart trends, or as a result of a performance or systems audit. Any quality problem that cannot be solved by immediate corrective action falls into this category. The QA Officer is responsible for managing the corrective action process and communicating the status of corrective action progress to the Division Manager. The QA Officer may, with the support of the Division Manager, delegate responsibilities for investigating problems and implementing solutions to appropriate operational groups or individuals. Involvement of the analyst and supervisor of the area concerned is crucial to the effectiveness of the corrective action process. It is the responsibility of analysts and supervisors to write corrective action reports, and it is the responsibility of the QA Officer to maintain the corrective action reports.

13.3 Corrective Action Procedure

13.3.1 Classification of Corrective Action Reports

a) Quality Control
b) Quality Procedure
c) External Audit
d) Internal Audit
e) Performance Testing (PT)

13.3.2 Method Suspension/Restriction

In some cases it may be necessary to suspend or restrict the use of a method when a nonconformance exists which constitutes significant risk and/or liability to TestAmerica Incorporated.

13.3.2.1 Prior to suspension/restriction, confidentiality will be respected and the problem and the required corrective action will be stated in writing and presented to the Division Manager.

13.3.2.2 The Technical Director, Quality Assurance Officer and affected group supervisor/leader will be notified.

13.3.2.3 Division Manager shall arrange with the appropriate operations people to come to meet with the Quality Assurance Officer the day of notification. This meeting shall be held to confirm that there is a problem, and that suspension/restriction of the method is required.

13.3.2.4 The meeting will conclude with a discussion of the steps necessary to bring the method or test fully back on line if the method is suspended or restricted. The Quality Assurance Officer will also specify any documentation necessary to verify that corrective action has occurred. A copy of the meeting notes and agreed upon steps should be emailed by the laboratory to Corporate Operations and Vice President of Quality Assurance. This email acts as notification of the incident.

13.3.2.5 After suspension/restriction, the lab will hold all reports to clients pending review. No faxing, mailing or distributing through electronic means may occur. It is the responsibility of the Division Manager to hold all reporting. Clients will NOT generally be notified at this time. Analysis may proceed in some instances depending on the nonconformance.

13.3.2.6 Lab management must determine if compliance is now met, and reports can be released, OR determine a written plan of action to bring work into compliance, and release work. A team, with all principals involved (Division Manager, Operations Manager, Quality Assurance Officer, Project Management, other), can devise a start-up plan to cover all steps from written client notification through compliance of method and release of reports.

13.3.3 Sample Receipt Problems:

The sample receipt problems are documented on the Sample Receipt and Temperature Log Form (Figure 7.4) by the login personnel. Section 7.3 contains documentation procedures for this form.

13.3.4 Systematic Problems (Quality Procedure)

Those problems of a procedural/systematic nature generally require the Division Manager's involvement. Examples might include previously reported data that has been affected by a situation requiring correction or if corrective action will impact project schedule or budget. If previous data is affected, the laboratory management staff is responsible for determining the significance of the problem and notifying the customer, of any event that casts doubt on the validity of the data. This notification must be documented on a Corrective Action Report (CAR) (Figure 13.1).

13.3.5 Departures from Documented Policies and Procedures

Due to the frequently unique nature of environmental samples, sometimes departures may be needed from documented policies and procedures. When the analyst encounters such a situation, he/she presents the problem to his/her supervisor for advice. The analyst may elect to discuss it with the Operations Manager and the Operations Manager/Project Coordinator contacts the client to decide on a logical course of action. Once an approach is agreed upon, the analyst so notes it in the raw data folder or in the logbook. This information can then be supplied to the client in the form of a footnote or a case narrative with the report.

13.3.6 Addressing Complaints

Addressing complaints is a normal function of conducting business and a valuable tool to improve services and relationships with clients. The goal is expeditious resolution of complaints. At TestAmerica Analytical Testing Corp – Cedar Falls, the supervisor and/or the management team handles systematic problems, specific complaints concerning container orders, shipping, expected report dates, and questions about specific sample reports. The staff documents the question on the Report/Result Re-evaluation Request Form (RER) (Figure 13-2). The staff researches the situation by reviewing the quote, raw data, Chain of Custody, method, regulations, etc., discusses the details with management who may decide to retain the result, require re-analysis, provide a case narrative and/or reissue the report. This form is filed in the Client's Project Report Folder. A copy of the RER form is filed with the Quality Assurance Officer.

13.3.7 External Auditing Authorities

Various auditing authorities may also initiate corrective action when deemed necessary. External Audits often require written reports that include proof of correction. The Quality Assurance Officer coordinates and writes this response.

13.3.8 Internal Audits

All deficiencies found during audits are reported to the Division Manager and management staff. Audit information is provided to the Director of Quality Assurance through the monthly reports (section 15 – Quality Assurance Reports to Management). The Division Manager and the Quality Assurance Officer agree upon a time frame for correction. The Quality Assurance Officer evaluates the laboratory's response and corrective action procedures when acceptable, and are attached to each audit filed. Issues that arise may require method suspension or restriction (13.3.1) and are documented in a CAR.

13.3.9 Performance Testing (PT) Evaluation and Blind Proficiency Study

A CAR must document all deficient PT samples. The response must address the reason for the unacceptable result. In most cases it will be necessary for Blind QC samples to be resubmitted to the laboratory to demonstrate a return to control.

13.3.10 For either immediate or long-term corrective actions, steps comprising a closed-loop corrective action system are as follows:

The essential steps in the closed loop corrective action system are:

a) Identification of the problem,
b) Assignment of responsibility for investigating the problem,
c) Determination of the cause of the problem through investigation,
d) Formulation of a corrective action plan,
e) Assignment of responsibility for implementation of the corrective action plan,
f) Monitoring the effectiveness of the corrective action plan,
g) Verifying the elimination of the problem,

h) Documenting the process involved.

13.3.11 Preventive Corrective Action

Preventive action is a pro-active process to identify opportunities for improvement rather than a reaction to the identification of problems.

Preventive action involves the use of a Process Evaluation Report (PER) database. The electronic PER database is used to track and organize specific non-conformances that occur within the laboratory. Information stored in this database is organized on a quarterly basis by the QAO and distributed to laboratory management for review and comment. Needed improvements and potential sources of non-conformances, either procedural or concerning the quality system, shall be identified. If preventive action is required, action plans shall be developed, implemented and monitored to reduce the likelihood of the occurrence of such non-conformances and to take advantage of the opportunities for improvement. The action plans developed and implemented are documented using the CAR (Section 13.3) system. The action plan is audited one month after implementation to ensure that non-conformances generated have been eliminated.

13.3.12 Unresolved Corrective Action

An unresolved corrective action is an extremely rare occurrence. In the event that a corrective action cannot be resolved for a lab process or analytical method, the laboratory will discontinue the lab process or analytical method.

Figure 13-1: Corrective Action Report (CAR)

TestAmerica
INCORPORATED

Cedar Falls, IA Division

Corrective Action Report (CAR) # 138

CAR Start Date: ___________

Due Date: ___________

Person Making Inquiry: ______________________________

☐ Quality Control ☐ Quality Procedure ☐ External Audit ☐ Internal Audit ☐ Performance Testing (PT)

Problem Description *(use back of page if addition space needed)*:

____

____

____

____

____

____

____

Recommendations/Conclusions:

____

____

____

____

____

____

Actual Resolution:

____

____

____

____

____

____

Operations Manager: ______________________ **Date:** ___________

QA Officer: ______________________ **Date:** ___________

Figure 13-2: Report RE-Evaluation Request Form (RER)

TestAmerica

Report/Result Re-evaluation Request

Initiated By: ______________ Date: ______________

Company Name: ______________ Phone #: ______________

Location: ______________ Fax # ______________

Client Contact: Sample Range/Job#:

Sample #	Parameter (s)/Batch	Original Result	Revised Result

Request Due By: ______________ To Whom: ______________

Action Requested

Technical / **Non-Technical**

☐ Dilution Error	☐ Check QC Data	☐ Report Format Change
☐ Add analyte/test missed on COC	☐ Remove analyte / test not on COC	☐ Sample Date Change
☐ Lower Reporting Limits	☐ Revise Test Method	☐ Project/Sample ID Change (*)
☐ Raise Reporting Limits	☐ Re-analysis/confirmation	☐ Missing Page/Report
☐ Check Result	☐ Report to MDL	☐ Extra Copies
☐ Need Lower Dilution	☐ Add/Delete Narrative	☐ Address Change
☐ Other (See Comments)	☐ Wrong Flag or No Flag	☐ Typo

Comments:

Action Taken

☐ No change necessary	☐ Units Changed	☐ False negative
☐ Reporting Limits Lowered	☐ Reporting Limits Elevated	☐ False positive
☐ Added Analytes requested on COC	☐ Added Analytes not requested on COC	☐ Flag Corrected / Added /Deleted (circle one and add comment below)
☐ Non-target compounds removed	☐ QC Data Edited (requires comment)	☐ Client note was not followed at time of analysis/initial review
☐ Re-analyzed	☐ Dilution Error	☐ Confirmation Needed
☐ Recalculated	☐ Re-analyzed / amend	☐ Revised Test Method
☐ Add/ Delete Narrative	☐ Dilution Lowered	☐ Results Reported at MDL

☐ Other/Comments:

☐ Report not amended	☐ Report amended and re-issued Date Sent: ______	☐ CAR Generated Num. ______ Date	☐ Client contacted Date: ______ Who: By:

______________ ______________
Completed By Date

REV 1

Section 14.0
Performance and System Audits

Audits measure laboratory performance and insure compliance with accreditation/certification and project requirements. Audits are of four main types: external, system, report and blind sample.

14.1 External Audits

External audits are performed when certifying agencies or clients submit samples for analysis and/or conduct on-site inspections. It is TestAmerica Analytical Testing Corp's policy to cooperate fully with certifying agencies. It is also TestAmerica Analytical Testing Corp's policy to comply fully with system audits conducted by regulatory agencies and clients.

The laboratory is involved in external performance audits conducted semi-annually through the analysis of Performance Testing (PT) samples provided by a third party. In the past these EPA performance testing studies have been referred to as Water Pollution Study (WP) and Water Supply Study (WS). Additional PTs are analyzed as required by clients and state certifying agencies. See section 14.4 for additional information. All deficiencies documented by external agencies are documented and corrected by the procedures in section 13.

14.2 System Audits

It is the responsibility of the Quality Assurance Officer to plan and organize audits as required by a predetermined schedule and as requested by management. Such audits shall be carried out by trained and qualified personnel who are, wherever resources permit, independent of the activity to be audited. Personnel shall not audit their own activities except when it can be demonstrated that an effective audit will be carried out. System audits evaluate procedures and documentation in the laboratory. Semi-annual audits are split into smaller audits that are performed within the specified frequency (see Figure 14-1). The Internal Audit Summary should be completed in January and July. An example audit checklist can be found in Figure 14-2. Additional audits may be necessary throughout the year to address specific project requirements or issues that arise from other audits. All deficiencies documented by system audits are documented and corrected by the procedures in section 13.

14.3 Report Audits

Routine report audits are the responsibility of the laboratory Quality Assurance Officer. The Quality Assurance Officer performs an independent systems review of reports generated by the laboratory. The reviewer is not expected to pursue the correctness of every reference in the file contents, but concentrates on the internal consistency of the data package. Areas for review include chain-of-custody, correspondence with the analytical request, batch QC status, completeness of any corrective action statements, 5% of calculations, format, holding time, sensibility and completeness of the project file contents. A list of reports reviewed is maintained in an audit file.

14.4 Blind Sample Audits

Blind sample audits are performed by submitting QC samples to the analyst with true values, which are only made known after the test is complete. Blind sample audits are carried out by the Quality

Assurance Officer, Technical Director, Corporate Director of Quality Assurance, clients and certifying agencies as necessary to assure the laboratory is capable of achieving success with a blind QC sample. For continuing NELAC accreditation, completion dates of successive proficiency rounds for a given PT field of testing shall be six months. Failure to meet the semi-annual schedule is regarded as a failed study.

14.4.1 It is recognized that PT samples are often not representative of "real world" samples either in their form (e.g. vials), content (e.g. multiple target analyte hits), or documentation (e.g. no chain of custody) and such present the laboratory with special challenges.

14.4.2 It is the policy of TestAmerica Analytical Testing Corp that PT samples be treated as typical samples in the normal production process where this is possible. Further, where PT samples present special or unique problems in the normal production process they need to be treated differently, as would any special or unique request submitted by any client.

14.4.3 Holding time begins when the vial is opened. Full volume PTs follow normal hold time procedures and storage requirements.

14.4.4 The PT samples are logged into LABSYS by the QA Officer for the applicable analytical tests and preparative procedure(s). Subsequent tracking of these samples is accomplished as per Section 7.4

14.4.5 Vials will be prepared as required in the instructions provided with the samples. After preparation to full volume the sample may be spiked, digested, concentrated, etc., as would be done for any normal sample requiring similar analysis.

14.4.6 Special QC samples can be included in the analytical run, only if this is what would be done with normal client samples under similar circumstances.

14.4.7 PT concentration is only allowed if the spiked levels in the PT occur below the laboratories normal reporting limit. When PT concentration occurs the analyst or Operation Manager must receive approval from the QAO prior to entering of data. A PT sample may be concentrated in way so that the dilution factor is kept at a minimum.

14.4.8 Deficient PT samples are documented and appropriate corrective action procedures are followed according to section 13.

14.5 Quality Systems Management Review

The senior management team (Division Manager, Operations Managers, Quality Assurance Officer, Technical Director(s), Office Manager conducts an annual review of its quality systems to ensure its continuing suitability and effectiveness in meeting client and regulatory requirements and to introduce any necessary changes or improvements. Corporate Operations and Corporate Quality Assurance personnel may be included in this meeting at the discretion of the Division Manager.

This review uses information generated during the preceding year to assess the "big picture" by ensuring that routine quality actions taken and reviewed on a monthly basis are not components of larger systematic concerns. The monthly review (see Section 15) should keep the quality systems current and effective, therefore, the annual review is a formal senior management process to review specific existing documentation.

14.5.1 Significant issues from the following documentation are summarized by the Quality Assurance Officer prior to the review meeting:

14.5.1.1 Matters arising from the previous annual review.

14.5.1.2 Prior Monthly Quality Assurance Reports.

14.5.1.3 Minutes from prior Senior Management team meetings, including:

a) Adequacy of staff, equipment and facility resources.
b) Future plans for resources and testing capability and capacity.

14.5.1.4 Prior Customer Service/Business Development meeting information.

14.5.1.5 Internal and External Audits.

14.5.1.6 Review of Corrective Action Reports (Figure 13-2)

14.5.1.7 Review of Report/Result Re-evaluation Request (RER) (Figure 13-3).

14.5.1.8 Proficiency Evaluation results.

14.5.1.9 Changes in policies and procedures of auditing authorities.

14.5.2 The annual review includes the previous 12 months and can occur anytime between December and February to best meet the needs of the Division. Based on the annual review, a report is generated by the Quality Assurance Officer and management. The report is distributed to Senior Management and the Corporate Director of Quality Assurance. The report includes, but is not limited to:

14.5.2.1 The date of the review and the names and titles of participants.

14.5.2.2 A reference to the existing data quality related documents and topics that were reviewed.

14.5.2.3 Quality system changes or improvements that will be made as a result of the review.

14.5.2.4 An implementation schedule including assigned responsibilities for the changes.

14.5.3 The Quality Assurance Manual may be revised at this time to reflect any significant changes made to the quality systems.

Figure 14-1

TestAmerica Analytical Testing Corp.

INTERNAL AUDITS SUMMARY

Division: ______________________

Time Period: ______________________

Number of Required Audits in 6 Month	Date(s) Performed	Description	Date Reported to Lab	Date Responses Complete
1		Balances: - Use of Standards - Use of Log - Acceptance Criteria		
1		Standards/Reagents: - Properly Labeled - Notebooks Used - Cert Binder Up To Date		
1		Maintenance Logs: - Preventive Maintenance - Repairs		
1		QA Manual/SOP Binders/Logbooks: - In Location - No Additional Marks - Logged		
1		Temperature Logs/Thermometers - Logs Up To Date - Thermometers in Place - No Expired Thermometers		
1		Miscellaneous: - pH check recordings - Conductivity - Etc …..		
1		Review Procedures: - Corrective Action Forms Used - Notebooks Reviewed and Signed Off - Hard Copies of All Data Available - Manual Integration Documentation Procedures Used - Manual Integration – Review on Screen		

Number of Required Audits in 6 Month	Date(s) Performed	Description	Date Reported to Lab	Date Responses Complete
1		Archive Procedures: - Hard Copies - System Back-ups		
1		Training Records: - P&A in Place for all Methods Run - SOPs Signed Off		
1		MDLs: - All instruments have a current MDL for all methods run on it. - MDL for solid and aqueous where appropriate.		
1		Log-in: - pH Checks - Documentation Procedures - Temperature Checks		
1		Control Limits / Charting		
1		Run Logs: -Proper QC Frequency		
1		Automated Forms & Spreadsheets		
Goal is to review all types of methods on an annual basis. Plan accordingly.		Method Audit: - Review SOP - Review Method - Review Worksheets		

QA Officer ____________________ Date ____________________

Attach signature page of each audit to this summary sheet. Send completed copy to Vice President of QA and file original.

Figure 14-2: Example Internal Audit Checklist (Pages 6-8)

INTERNAL AUDIT

TestAmerica Incorporated – ______________________

Date(s):	
Area Audited	Archiving
Persons Contacted During Audit:	
Auditor	

Date Reported to Department Management	
Reported To:	
Date Reported to Division Manager:	
Reported To:	

Please review the checklist and comments attached. Comments are identified by the item number in the checklist. Please respond to all comments within one week of the "Date Reported to Department Management".

Date: ___________________ QA Signature: ___________________________________

Response received and accepted by QA:

Date: ___________________ QA Signature: ___________________________________

Note: Attach a copy of this signature page to the Internal Audit Summary. File original with responses in audit file.

AUDIT CHECKLIST: Archiving

		Yes	No
1.	The archive log(s) include: ❑ A unique box identifier. ❑ A description of the contents of the box. ❑ The location of the box. ❑ The date of disposal.		
2.	Access to archived information is documented with an access log (either per archive area or per box). The log contains the date/time, initials and description of items removed, reviewed or returned.		
3.	Archive boxes are labeled with a unique box identifier and a means for identifying the time for disposal. This would also apply to electronic records.		
4.	Archive locations are protected against fire, theft, loss, environmental deterioration and vermin. In addition, electronic records are protected against electronic or magnetic sources.		
5.	Instructions for the retrieval of electronic records are archived with the electronic records when necessary to facilitate retrieval.		
6.	The laboratory has identified a time period to maintain data records? (________ years).		
7.	Records that are stored by computers or personal computers (PCS) have hard copy or write-protected back-up copies. Applicable method files are backed up.		
8.	Records stored only on electronic media, are supported by the hardware and software necessary for their retrieval.		
9.	The LIMS is backed up a minimum of once per day.		
10.	A copy of the LIMS back-up is stored off-site.		

AUDIT CHECKLIST: Archiving

	Yes	No
10. The laboratory maintains all information necessary for the historical reconstruction of data. Examples: ❑ Copy of COC. ❑ Log-in Record. ❑ Internal Chain Record (where applicable). ❑ Worksheets/Logbooks/Notebooks ❑ Standard Preparation Log ❑ Calibration Logs – Balance, instrument, pipet, thermometers, …. ❑ Run Logs ❑ Raw Data ❑ Final Report ❑ QA Manual/SOPs ❑ MDLs ❑ QC Limits		

Comments:

Section 15.0
Quality Assurance Reports to Management

15.1 Internal Reports

The Quality Assurance Officer (QAO) is to submit a monthly report regarding QA/QC activities to laboratory management (Division Manager and Operations Managers) and the Vice President of Quality Assurance. An example format with the minimum required topics for reporting can be found in Figure 15-1.

15.2 External Reports

Certain projects under regulatory review require establishment of explicit quality assurance objectives and quarterly summaries of QA conformance and corrective action. The laboratory technical and quality assurance staff will provide information required to establish quality assurance objectives for particular projects. Once the QA deliverables options are selected for the project, sufficient quality control data will be provided in the individual analytical report to allow a periodic assessment of the overall progress of the project. Upon request, any information/reports needed will be provided by the laboratory management with review by the QAO.

Figure 15-1

TestAmerica Analytical Testing Corp.

Cedar Falls

QA MONTHLY REPORT TO MANAGEMENT

LABORATORY: Cedar Falls
PERIOD COVERED: Date
PREPARED BY: Mark McGowan
TO: Mike McGee (Division Manager), Kevin Keeley (Vice President of Operations)
CC: Derrick Klinkenberg (Organic Operations Manager), Kristin Clay (Inroganic Operations Manager), and Brian Graettinger (IH / Field Services Manager), Shawn Hayes (Project Coordinator).
Ilona Tauton, Vice President of Quality Assurance

THREE KEY ISSUES:

1.
2.
3.

---

1. **SOPs**
   1.1 The following SOPs were finalized (Include updated SOP Summary with Report):

   1.2 The following SOPs are in QA for review:

   1.3 The following SOPs are due to QA:

2. **Corrective Action Reports (CARs)**
   2.1 Total Number of CARs: 0
   2.2 Number of Unresolved CARs: 0
   2.3 Highlights:

3. **MDLs**
   3.1 MDLs Completed:

   3.2 MDLs Due:

   3.3 MDLs Past Due:

4. **AUDITS**
   4.1 <u>INTERNAL AUDITS</u>
   The following internal audits were performed (include method and general):

   4.2 <u>EXTERNAL AUDITS</u>
   (Include source, date, highlights, date Corrective Action Package is due, Progress on Corrective Action Packages, ..)

5. **PT SAMPLES**

5.1 The following PT samples are now in house (Due Dates):

5.2 The following PT results have been received (Results presented as a percentage by Department, Discuss Corrective Action):

5.3 Laboratory PE Score

5.3.1 PE Score (January 1, 2005 to Present)

Study Name	Total Acceptable Points	Total Points Entered	Study Proficiency	Closing Month/Year

Summary Total

Total Acceptable Points	Total Points Entered	Proficiency Average

5.3.2 ALCOA PE Score (January 1, 2004 to Present)

Study Name	Total Acceptable Points	Total Points Entered	Study Proficiency	Closing Month/Year

Summary Total

Total Acceptable Points	Total Points Entered	Proficiency Average

6. **CERTIFICATIONS**

6.1 Certification Packages Being Worked On (Include Due Date):

7. **TRAINING**

7.1 Training Record Issues: NONE

7.2 Training Performed: Numerous

8. **REGULATORY UPDATE**

9. **MISCELLANEOUS**

10. **NEXT MONTH:**

Division Manager Comments

____   _______________

Division Manager Signature | Date

Appendix 1:

TESTAMERICA ETHICS POLICY AND CODE OF ETHICAL CONDUCT

It is the policy of TestAmerica that every employee shall at all times and in all ways comply with both the letter and the spirit of federal, state and local laws, and that every employee shall adhere to the highest standards of ethics, morality, honesty and decency in the performance of the duties of his or her job. TestAmerica strives to create an ethical "culture" through top-down example with an emphasis on doing things the "right way" for the "right reasons". The consequences of non-compliance can be severe to both the environment and the company. The actions of one employee can jeopardize the entire company. The company has a zero tolerance policy for illegal, unethical and improper practices that affect the integrity of all data the company produces.

1.1 TestAmerica Code of Ethical Conduct

TestAmerica has adopted a Code of Ethical Conduct, to which each employee must adhere, as follows:

a) To serve human health and environmental interests by performing analytical and testing responsibilities in a manner that justifies the public trust.

b) To present services in a confidential, honest, and candid manner. Facility/location procedures, client names and their results are not discussed outside of the company except with an approved client agent.

c) To produce results that are both accurate and defensible.

d) To comply with all written procedures (i.e., Quality Assurance (QA) Manual, Standard Operating Procedures (SOPs), Safety Manual, Human Resources Manual, etc.). Members of management must comply with all applicable federal, state, and local laws and regulations consistent with accepted professional and analytical practices.

e) To understand and adhere to the guidelines of ethical and quality work that meet the standards required by the environmental testing industry.

1.2 Data Quality Assurance Program

TestAmerica wants to ensure a national standard of quality at all TestAmerica locations.

Each TestAmerica laboratory has a Quality Assurance Manual that focuses on quality related test specifications performed by that laboratory. Documented quality systems are designed to insure that work performed in the laboratory is accurate, precise, complete, comprehensive, and reflects the needs of the customer/client.

1.3 Ethics Quality Commitment, Objective, and Policy

TestAmerica wants to ensure quality analytical and data management services to meet the needs of customers/clients while satisfying the requirements of appropriate state and federal regulations. This enables the customer/client to make rational, confident, cost-effective decisions on the assessment and resolution of environmental problems. Protocols and procedures utilized by laboratories, with emphasis on the Quality Assurance/Quality Control (QA/QC) requirements, are based on EPA guidelines.

It is the policy of TestAmerica to incorporate quality into all analytical programs by adhering to the following practices:

a) TestAmerica will not offer any analysis for which we cannot demonstrate consistent quality and defensible analyses;

b) Employees who are aware of falsification or misrepresentation of facts regarding analytical results or the manipulation of data are required to immediately inform the appropriate member of Management;

c) TestAmerica has "Open Door" and "Open Line" Policies which enable every TestAmerica employee to have free access to the respective Manager and Corporate Officers. Such Open Door Policies are intended to foster two-way communications and provide each employee with access to Laboratory and Corporate Management. Such Policies are also intended to encourage each employee to consider it his or her duty and responsibility to "come forward". Any employee who disagrees with or has a concern or question about any Company practice, process, procedure, or policy, or about any Supervisory/Managerial request, instruction, or directive should come forward. This includes concerns about any undue pressures placed upon an employee which adversely affects the quality of work produced. Such contact should be made to members of Laboratory or Corporate Management. Any contacts with a Manager or representative of Corporate shall be treated as "confidential", within the confines of any legal requirements placed upon the Company, if the employee so requests. The employee may also contact their Human Resources representative.

d) No employee of TestAmerica will compare or disclose results for any Performance Testing (PT) sample, or other similar QA or QC requirements, with any employee of any other laboratory, including any other TestAmerica laboratory, prior to the required submission date of the results to the person, organization, or entity supplying the PT sample.

1.4 TestAmerica Code of Ethical Conduct Agreement

I. I understand that I am charged with meeting ethical standards in performing all of my duties and responsibilities;

II. I have been formally instructed to consider quality as an important aspect of my job responsibilities. The provisions of the "Ethics Policy and Code of Ethical Conduct" have also been reviewed with me. In as much, it is understood that ethical performance and data integrity must supersede any other operational objective.

III. I also agree to the following:

   a) I shall not report data inconsistent with actual values observed or measured.

   b) I shall not modify data (either sample or QC data) unless the modification can be technically justified through a measurable analytical process, such as one deemed acceptable to the laboratory's Standard Operating Procedures, Quality Assurance Manual or Technical Director. All such modifications must be clearly and thoroughly documented in the appropriate laboratory notebooks/worksheets and/or raw data and include my initials or signature and date.

c) I shall not intentionally report dates and times of analyses that do not represent the true and actual dates and times the analyses were conducted.

d) I shall not intentionally represent another individual's work as my own or represent my work as someone else's.

e) I shall not make false statements to, or seek to otherwise deceive, members of Management or their representatives, agents, or clients/customers. I will not, through acts of commission, omission, erasure, or destruction, improperly report measurement standards, quality control data, test results or conclusions.

f) I shall not condone any accidental or intentional reporting of inauthentic data by other employees and will immediately report its occurrence. If I have actual knowledge of such acts committed by any other employees, and I do not report such information to designated members of Management, it shall be considered as serious as if I personally committed the offense. Accordingly, in that event, I understand that I may be subject to immediate termination of employment.

g) I shall immediately inform my supervisor or other member of management regarding any intentional or unintentional reporting of my own inauthentic data. Such report shall be given both orally and in writing to the supervisor or other member of management contacted and to the local Quality Assurance Officer/Manager. The Quality Assurance Officer/Manager will initial and date the information and return a copy to me.

h) I shall not accept gifts of a value that would adversely influence judgment.

i) I shall avoid conflicts of interest and report any potential conflicts to the management (e.g. employment or consulting with competitors, clients, or vendors)

j) I shall not participate in unfair competition practices (e.g. slandering competitors, collusion with other labs to restrict others from bidding on projects)

k) I shall not misrepresent certifications and status of certifications to clients or regulators

l) I shall not intentionally discharge wastes illegally down the drain or onto the ground.

m) I understand that any attempt by management or an employee to circumvent these policies will be subject to disciplinary action.

I understand the critical importance of accurately reporting data, measurements, and results, whether initially requested by a client, or retained by TestAmerica and submitted to a client at a later date, or retained by TestAmerica for subsequent internal use.

I understand that if any supervisor, manager, or representative of management instructs, requests, or directs me to perform any of the aforementioned improper laboratory practices, or if I am in doubt or uncertain as to whether or not such laboratory practices are proper, I will not comply. In fact, I must report such event to all appropriate members of Management including, but not limited to, the Manager, all supervisors and managers with direct line reporting relationship between me and the Manager, and the local Quality Assurance representative, excluding such individuals who participated in such perceived improper instruction, request, or directive. In addition, I may contact Corporate Quality Assurance / Ethics Compliance Officer(s) for assistance.

The Ethics and Compliance Officers are:

- Ilona Taunton: ITaunton@TestAmericaInc.com (Located in Asheville, NC)

  Office: (828) 258-3746

  Cell: (828) 712-9242

- Scott Hoatson: SHoatson@TestAmericaInc.com (Located in Irvine, CA)

  Office: (949) 260-3233

  Cell: (949) 283-0458

I should obtain a ruling, in writing, as to whether such practice is or is not improper and will abide by such ruling. However, if I have not received a timely ruling, or if I believe such ruling is incorrect, I may appeal to the Division Exec VP/COO or President/CEO and will abide by such written ruling.

I understand that if my job includes supervisory responsibilities, I shall not instruct, request, or direct any subordinate to perform any laboratory practice which is unethical or improper. Also, I shall not discourage, intimidate, or inhibit an employee who may choose to appropriately appeal my supervisory instruction, request, or directive which the employee perceives to be improper, nor retaliate against those who do.

I have read and fully understand all provisions of the "Ethics Policy and Code of Ethical Conduct" and realize that even one instance of variance from the above Code of Ethical Conduct will result in discipline, up to and including termination of employment. I have also viewed the 2005/2006 Ethics Presentation.

____________________ (Dated)

____________________ (Employee's Signature)

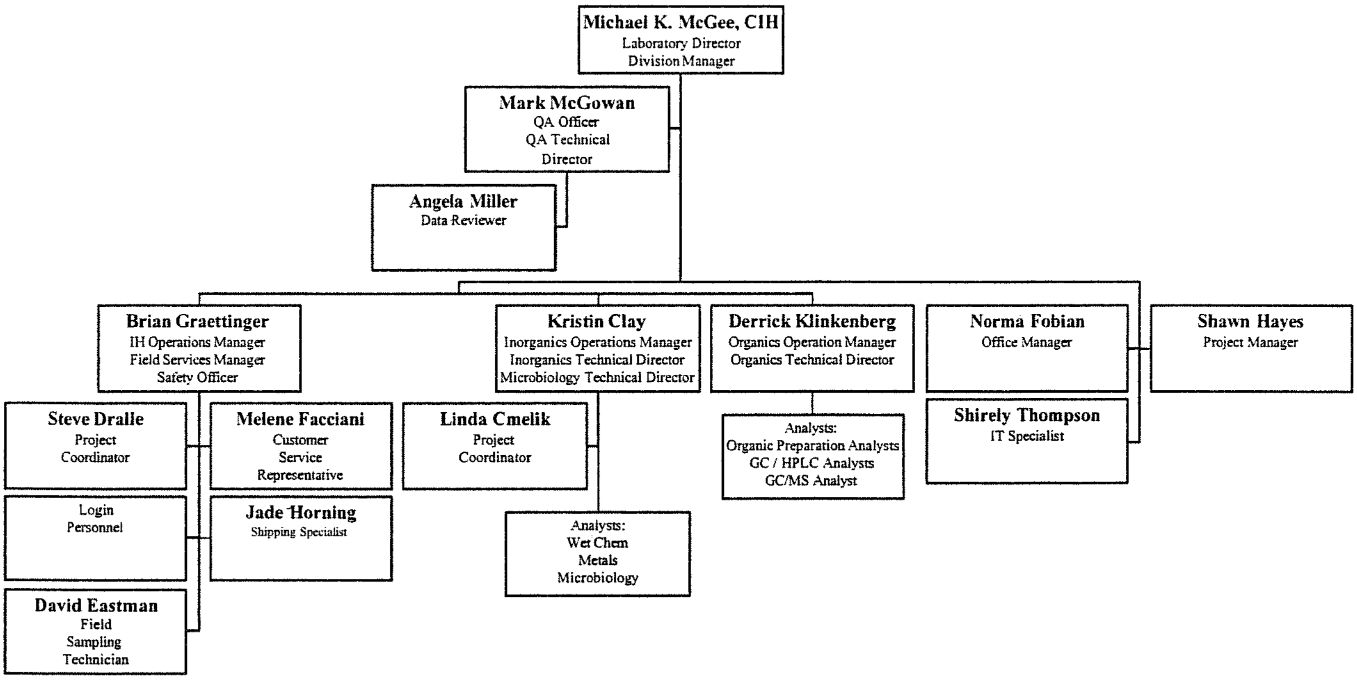
____________________ (Print Name)

____________________ (If applicable, Employee ID Number)

NOTE: This Ethics Policy and Code of Ethical Conduct must be signed at the time of hire (or within 2 weeks of an employee's initial receipt of this Policy, if later) and re-signed annually. Such signature is a condition of continued employment. Failure to sign will result in immediate termination of employment.

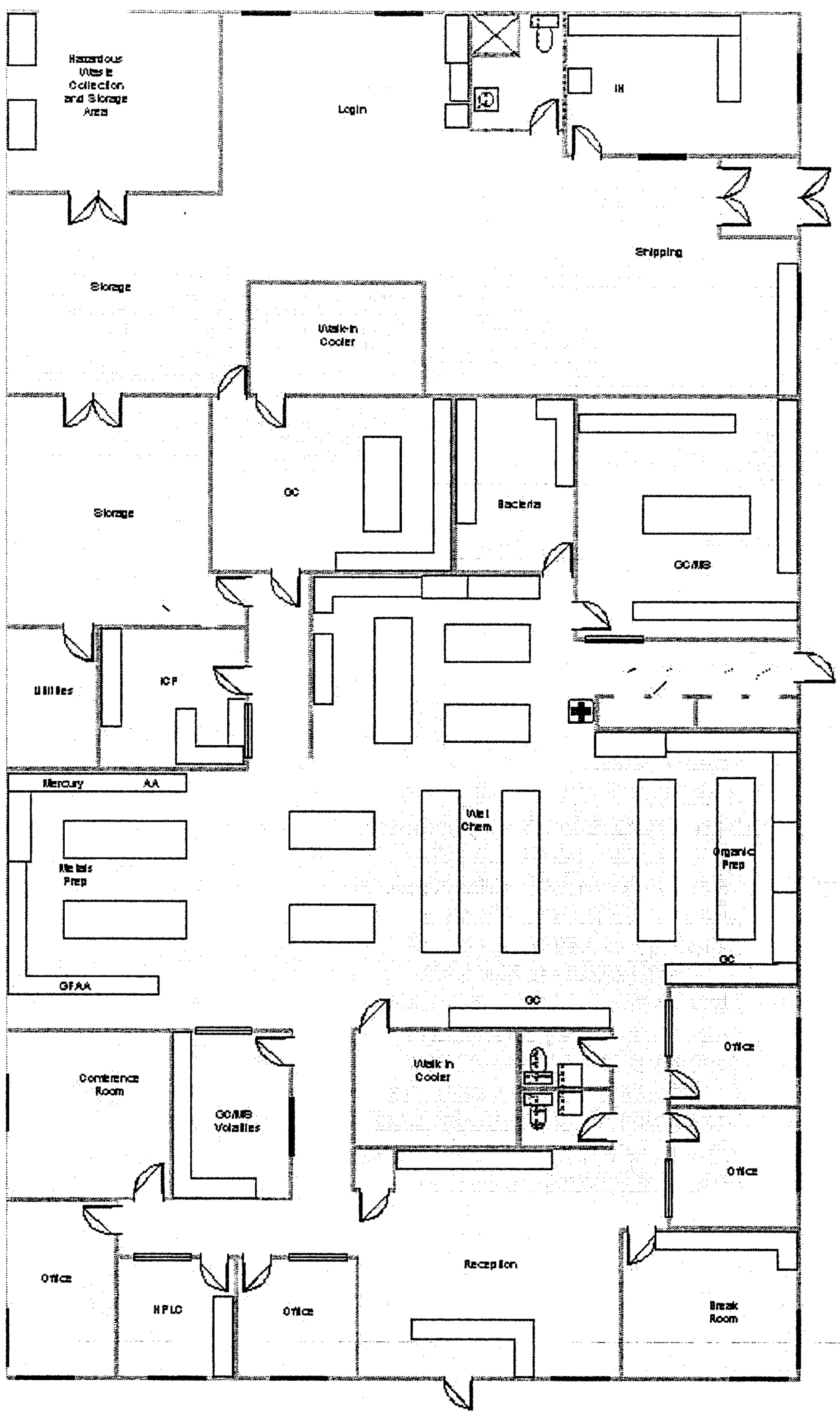
2/05

Appendix 2: TestAmerica Analytical Testing Corp – Cedar Falls Organization Chart



Name	Email Address
Mike McGee	MMcGee@TestAmericaInc.Com
Brian Graettinger	BGraettinger@TestAmericaInc.Com
Kristin Clay	KClay@TestAmericaInc.Com
Derrick Klinkenberg	DKlinkenberg@TestAmericaInc.Com
Shawn Hayes	SHayes@TestAmericaInc.Com
Norma Fobian	NFobian@TestAmericaInc.Com
Steve Dralle	SDralle@TestAmericaInc.Com
Melene Facciani	MFacciani@TestAmericaInc.Com
Linda Cmelik	LCmelik@TestAmericaInc.Com
Jade Horning	JHorning@TestAmericaInc.Com
David Eastman	DEastman@TestAmericaInc.Com
Shirley Thompson	SThompson@TestAmericaInc.Com
Mark McGowan	MMcGowan@TestAmericaInc.Com
Angela Miller	AMiller@TestAmericaInc.Com

Appendix 3: Laboratory Floor Plan – TestAmerica Analytical Testing Corp - Cedar Falls Division



Appendix IV

This appendix lists the applicable calibration and QC procedures utilized for the indicated test methods at TestAmerica - Cedar Falls Division. These tables are intended as a overall view of the procedures indicated and is not an exhaustive tabulation of all methods, analytes and method calibration and QC procedures. For specific procedures regarding a particular tests or methods refer to the SOP.

Table A-1 Summary of Calibration and QC Procedures for GC/MS Organics

Method Reference	QC Check	Frequency	Acceptance Criteria	Corrective Action
EPA 624	Check of relative ion intensities with BFB	Prior to initial calibration or continuing calibration verification (per analytical batch)	Relative ion acceptance criteria listed in method	Retune the MS, re-analyze tune run, perform routine maintenance (Table 10-2)
	Initial calibration (minimum 3 point)	Prior to sample analysis	%RSD <35% for all analytes	Correct problem; re-analyze
	Initial calibration verification (ICV) utilizing an independent standard source	Immediately following initial calibration and prior to the analysis of any samples	All analytes within 30% of expected value	Correct problem; re-analyze initial calibration and ICV
	Continuing Calibration Verification (CCV)	Prior to analysis of samples,blanks,MS/MSD's, LCS's (per analytical batch)	Volatiles (EPA 624) - % Difference within criteria specified in method (or within limits specified by the lab)[1];	Correct the problem and re-analyze the CCV; if an acceptable CCV cannot be achieved, re-analyze initial calibration
	Method Blank	EPA 624 – one per analytical batch	No analytes detected > RL (except common lab solvents which can be 5X the reporting limit)	Correct problem, re-analyze all samples and QC that were analyzed following the blank.
	Laboratory Control Sample	One per analytical Batch	See Table 5-9	Correct problem; re-analyze the LCS and all samples associated with the failed LCS; alternatively, enter the data and flag affected analytes with failed LCS
	Matrix Spike	One per analytical batch	See Table 5-9	Flag analytes with failed MS
	Surrogate spike	All samples, method blanks, LCS, MS	See Table 5-9	Correct the problem, re-analyze the sample; if re-analysis does not produce acceptable results, flag data for failed surrogate
	Reporting Limit Verification Standard	Immediately following initial calibration and prior to the analysis of any samples	All analytes within calculated ranges	Re-analyze, elevate reporting limit within the calibration curve
	Internal Standards (IS)	All Analyses	+200% to –50% of the CCV Internal Standard	Re-analyze, at dilution if necessary (to eliminate interferences); if problem is not corrected, flag data affected by out-of-control IS

[1] For GG/MS Volatiles by EPA 624 - %Difference criteria specified by the lab cannot exceed the limits specified in the method

Table A-1 Summary of Calibration and QC Procedures for GC/MS Organics (Con't)

Method Reference	QC Check	Frequency	Acceptance Criteria	Corrective Action
SW 8260 B	Check of relative ion intensities with BFB	Prior to initial calibration or continuing calibration verification (per analytical batch)	Relative ion acceptance criteria listed in method	Retune the MS, re-analyze tune run, perform routine maintenance (Table 10-2)
	Initial calibration (minimum 5 point)	Prior to sample analysis	%RSD <15% for all analytes Selected analytes can exceed 15% if mean %RSD is <15%; minimum Mininmum RF for SPCC[2] must be met Max %RSD for CCC[3] is 30%	Correct problem; re-analyze;
	Initial calibration verification (ICV) utilizing an independent standard source	Immediately following initial calibration and prior to the analysis of any samples	All analytes within 30% of expected value	Correct problem; re-analyze initial calibration and ICV
	Continuing Calibration Verification (CCV)	Prior to analysis of samples,blanks,MS/MSD's, LCS's (per analytical batch)	% Difference <20% for all analytes (exceptions <50%, See Table A-14); minimum RF for SPCC compounds is .300 (0.100 for bromoform)	Correct the problem and re-analyze the CCV; if an acceptable CCV cannot be achieved, re-analyze initial calibration
	Method Blank	One per analytical batch	No analytes detected > RL (except common lab solvents which can be 5X the reporting limit)	Correct problem, re-analyze all samples and QC that were analyzed following the blank.
	Laboratory Control Sample	One per analytical Batch	See Table 5-9	Correct problem; re-analyze the LCS and all samples associated with the failed LCS; alternatively, enter the data and flag affected analytes with failed LCS
	Reporting Limit Verification Standard	Immediately following initial calibration and prior to the analysis of any samples	All analytes within calculated ranges	Re-analyze, elevate reporting limit within the calibration curve

[2] SPCC – System performance check; these compounds (minimum RF) are Bromform(0.100), Chlorobenzene(0.300), Chloromethane(0.100), 1,1- Dichloroethane(0.100), 1,1,2,2-Tetrachloroethane(0.300)
[3] CCC – Calibration check compounds – 1,1-Dichloroethene, Chloroform, Toluene, Vinyl Chloride, 1,2-Dichloropropane, Ethylbenzene

Table A-1 Summary of Calibration and QC Procedures for GC/MS Organics (Con't)

Method Reference	QC Check	Frequency	Acceptance Criteria	Corrective Action
SW-846 8260 B (Con't)	Matrix Spike/Matrix Spike Duplicate	One per analytical batch	See Table 5-9	Flag analytes with failed MS or MSD or failed RPD
	Surrogate spike	All samples, method blanks, LCS, MS/MSD	See Table 5-9	Correct the problem, re-analyze the sample; if re-analysis does not produce acceptable results, flag data for failed surrogate
	Internal Standards	All Analyses	+200% to –50% of the CCV Internal Standard	Re-analyze, at dilution if necessary (to eliminate interferences); if problem is not corrected, flag data affected by out-of-control IS
EPA 625/ SW-846 8270 C	Check of relative ion intensities of DFTPP; breakdown of DDT	Prior to initial calibration or continuing calibration verification (per analytical batch)	Relative ion acceptance criteria listed in method; <20% breakdown of DDT	Retune MS; perform injection port maintenance (See Table 10-2)
	Initial calibration (minimum 5 point)	Prior to sample analysis	RSD <15% for all analytes Selected analytes can exceed 15% if mean %RSD is <15%; Mininmum RF for SPCC[4] is 0.050 Max %RSD for CCC[5] is 30%	Correct problem; re-analyze
	Initial calibration verification (ICV) utilizing an independent standard source	Immediately following initial calibration and prior to the analysis of any samples	All analytes within 30% of expected value	Correct problem; re-analyze initial calibration and ICV
	Continuing Calibration Verification (CCV)	Prior to analysis of samples, blanks, MS/MSD's, LCS's (per analytical batch)	All analytes % Difference <20% (50% for compounds listed in Table A-15	Correct the problem and re-analyze the CCV; if an acceptable CCV cannot be achieved, re-analyze initial calibration
	Method Blank	One per preparation batch	No analytes detected > RL (except phthalates which can be 5X the reporting limit)	Re-extract samples in the extraction batch; if insufficient sample for re-preparation then flag data for analytes detected above RL in the blank

[4] SPCC – System performance check; these compounds are N-Nitroso-di-N-propylamine, Hexachlorocyclopentadiene, 2,4-Dinitrophenol, 4-Nitrophenol
[5] CCC – Calibration check compounds – see Table 4 of SW-846 Method 8270C

Table A-1 Summary of Calibration and QC Procedures for GC/MS Organics				
Method Reference	**QC Check**	**Frequency**	**Acceptance Criteria**	**Corrective Action**
EPA 625/ SW-846 8270 C (Con't)	Laboratory Control Sample	One per analytical Batch	See Table 5-7	Enter the data and flag affected analytes with failed LCS
	MS/MSD	One per analytical batch	See Table 5-7	Flag analytes with failed MS or MSD or failed RPD
	Surrogate spike	All samples, method blanks, LCS, MS	See Table 5-7	Correct the problem, re-analyze the sample; if re-analysis does not produce acceptable results, flag data for failed surrogate
	Internal Standards	All Analyses	+200% to -50% of the CCV Internal Standard	Re-analyze, at dilution if necessary (to eliminate interferences); if problem is not corrected, flag data affected by out-of-control IS

Table A-2 Summary of Calibration and QC Procedures for Purgeable GC Organics				
Method Reference	**QC Check**	**Frequency**	**Acceptance Criteria**	**Corrective Action**
OA-1 (BETX and Gas) and 8021A (Soils and Waters for both Methods	Initial Calibration (Minimum 5 point)	Prior to sample analysis	%RSD< 15%	Re-analyze
	Initial Calibration Verification (ICV)	Immediately following initial calibration and prior to sample analyses	<20% Difference between initial calibration and ICV	Re-analyze initial calibration
	Continuing Calibration Verification	Prior to analysis of samples, blanks, MS/MSD's, LCS's (per analytical batch)	<20% Difference between initial calibration and CCV, <15% Difference for single component	Re-analyze CCV; if an acceptable CCV cannot be analyzed, re-analyze initial calibration
	Method Blank	One per analytical batch	No analytes detected > RL	Correct problem, Re-analyze CCV and Blank
	Laboratory Control Sample	One per analytical Batch	See Table 5-9 (Waters) or Table 5-16 (Soils)	Correct problem, re-analyze CCV, Blank, LCS
	MS/MSD	One per analytical batch	See Table 5-9 (Waters) or Table 5-16 (Soils)	Flag data for failed MS or MSD recovery or failed RPD
	Surrogate	Each analysis (except Gas CCV)	See Table 5-9 (Waters) or Table 5-16 (Soils)	Correct problem, re-analyze

Table A-3 Summary of Calibration and QC Procedures for Extractable GC Organics

Method Reference	QC Check	Frequency	Acceptance Criteria	Corrective Action
SW-846 Method 8082 (PCB) and EPA 608 (Wastewaters only)	Initial Calibration (ICAL) (Minimum 5 point)	Prior to analysis of samples, QC	%RSD <15%	Correct problem, Re-analyze
	Initial Calibration Verification (ICV)	Immediately following ICAL and prior to analysis of samples, QC	% Difference <20%	Re-prepare ICV standard and re-analyze; if ICV still fails, re-analyze ICAL and ICV
	Continuing Calibration Verification	Prior to analysis of samples, blanks, MS/MSD's, LCS's (per analytical batch)	<15% Difference between initial calibration and CCV	Re-analyze CCV; if an acceptable CCV cannot be analyzed, re-analyze initial calibration
	Method Blank	One per preparation batch	No analytes detected > RL	Correct problem, re-analyze blank; if re-analyzed blank still does not meet criteria, re-prep batch
	Laboratory Control Sample	One per preparation Batch	See Table 5-8 (Waters) or Table 5-15 (Soils and other matrices)	Correct problem, re-analyze CCV, Blank, LCS
	MS/MSD	One per preparation batch	See Table 5-8 (Waters) or Table 5-15 (Soils and other matrices)	Flag data for failed MS or MSD recovery or failed RPD
	Surrogate	Each analysis	See Table 5-8 (Waters) or Table 5-15 (Soils and other matrices)	Correct problem, re-analyze; if surrogates still fail acceptance criteria, flag data accordingly
OA-2 (Extractable Hydrocarbons, Waters and Soils)	Initial Calibration (ICAL) (Minimum 5 point)	Prior to analysis of samples, QC	%RSD <15%	Correct problem, Re-analyze
	Initial Calibration Verification (ICV)	Immediately following ICAL and prior to analysis of samples, QC	% Difference <20%	Re-prepare ICV standard and re-analyze; if ICV still fails, re-analyze ICAL and ICV
	Continuing Calibration Verification	Prior to analysis of samples, blanks, MS/MSD's, LCS's (per analytical batch)	<~~15~~20% Difference between initial calibration and CCV	Re-analyze CCV; if an acceptable CCV cannot be analyzed, re-analyze initial calibration
	Method Blank	One per preparation batch	No analytes detected > RL	Correct problem, re-analyze blank; if re-analyzed blank still does not meet criteria, re-prep batch
	Laboratory Control Sample	One per preparation Batch	See Table 5-8 (Waters) or Table 5-15 (Soils and other matrices)	Correct problem, re-analyze CCV, Blank, LCS; if LCS still fails, re-prep the batch or flag data accordingly

Table A-3 Summary of Calibration and QC Procedures for Extractable GC Organics (Con't)				
Method Reference	**QC Check**	**Frequency**	**Acceptance Criteria**	**Corrective Action**
OA-2 (Extractable Hydrocarbons, Waters and Soils)	MS/MSD	One per preparation batch	See Table 5-8 (Waters) or Table 5-15 (Soils and other matrices)	Flag data for failed MS or MSD recovery or failed RPD
	Surrogate	Each sample and QC	See Table 5-8 (Waters) or Table 5-15 (Soils and other matrices)	Correct problem, re-analyze; if surrogates still fail acceptance criteria, flag data accordingly

Table A-4 Summary of Calibration and QC Procedures for Direct Aqueous Injection (DAI) Organics				
Method Reference	**QC Check**	**Frequency**	**Acceptance Criteria**	**Corrective Action**
OA-1 (BETX and Gas) and 8015A (Soils and Waters for both Methods	Initial Calibration (ICAL) (Minimum 5 point)	Prior to analysis of samples, QC	Linear Correlation Coefficient >0.990	Correct problem, Re-analyze
	Initial Calibration Verification (ICV)	Immediately following ICAL and prior to analysis of samples, QC (Assuming an independent standard is available)	% Difference <20%	Re-prepare ICV standard and re-analyze; if ICV still fails, re-analyze ICAL and ICV
	Continuing Calibration Verification	Prior to analysis of samples, blanks, MS/MSD's, LCS's (per analytical batch) and every 20 analyses and at the end of an analytical batch	<15% Difference between initial calibration and CCV	Re-analyze CCV; if an acceptable CCV cannot be analyzed, re-analyze initial calibration and all samples and QC associated with the failed CCV
	Method Blank	One per analytical batch	No analytes detected > RL	Correct problem, re-analyze blank
	Laboratory Control Sample	One per analytical Batch	See Table 5-17	Correct problem, re-analyze LCS
	MS/MSD	One per analytical batch	See Table 5-17	Try to correct by diluting sample; if sample dilution fails Flagdata for failed MS or MSD recovery or failed RPD

Table A-5 Summary of Calibration and QC Procedures for HPLC Organics

Method Reference	QC Check	Frequency	Acceptance Criteria	Corrective Action
SW-846 Method 8310 – Polynuclear Aromatics (PNAs)	Initial Calibration (ICAL) (Minimum 5 point)	Prior to analysis of samples, QC	Linear Correlation Coefficient >0.995	Correct problem, Re-analyze
	Initial Calibration Verification (ICV)	Immediately following ICAL and prior to analysis of samples, QC	% Difference <25%	Re-prepare ICV standard and re-analyze; if ICV still fails, re-analyze ICAL and ICV
	Continuing Calibration Verification	Prior to analysis of samples, blanks, MS/MSD's, LCS's (per analytical batch) and every 10 analyses	<15% Difference between initial calibration and CCV	Re-analyze CCV; if an acceptable CCV cannot be analyzed, re-analyze initial calibration and all samples and QC associated with the failed CCV
	Method Blank	One per preparation batch	No analytes detected > RL	Correct problem, re-analyze blank; if re-analyzed blank still does not meet criteria, re-prep batch
	Laboratory Control Sample	One per preparation Batch	See Table 5-7 (Waters) or Table 5-14 (Soils)	Correct problem, re-analyze LCS; if LCS still fails acceptance criteria, re-prep the batch or flag the data accordingly
	MS/MSD	One per preparation batch	See Table 5-7 (Waters) or Table 5-14 (Soils)	Flag data for failed MS or MSD recovery or failed RPD
	Surrogate	Each sample and QC	See Table 5-8 (Waters) or Table 5-15 (Soils and other matrices)	Correct problem, re-analyze; if surrogates still fail acceptance criteria, flag data accordingly

Table A-6 Summary of Calibration and QC Procedures for Metals by ICP

Method Reference	QC Check	Frequency	Acceptance Criteria	Corrective Action
EPA Method 200.7 and SW-846 Method 6010B	Initial Calibration (minimum 1 standard and a blank)	Daily, prior to sample analyses	NA	NA
	Initial Calibration Verification (ICV)	Following each initial calibration	Mean value of all analytes ±5% (10% for 6010B) expected value	Correct problem then re-analyze
	Linear Dynamic Range	Once Annually	All analytes within 10% of expected value or within analyst's judgement	Calibration range lowered to meet LDR results
	Reagent Blank	After every calibration verification	No analytes detected >RL	Re-analyze blank
	Continuing Calibration Verification (CCV)	Before sample analysis, after every 10 samples and at the end of the analytical sequence	All analytes <5% (10% for 6010B) of expected value before sample analysis, <10% after sample analysis has begun	Re-analyze CCV ; if CCV still fails acceptance criteria, repeat analytical batch calibration sequence and re-analyze all samples since last successful CCV.
	Method Blank	One per preparation batch	No analyses >RL	Re-analyze prep blank; if blank still fails, correct problem then re-prep entire batch and re-analyze
	Interference check solution	At beginning and at end of analytical batch	80-120% Recovery	Correct problem, re-analyze ICS and all samples and QC following ICS
	LCS	One per prep batch	See Tables 5-6, 5-13	Correct problem and re-prep batch
	Matrix Spike/Matrix Spike Duplicate	One per analytical batch	See Tables 5-6, 5-13	Flag data appropriately
	Post Digestion Spike	Each new sample matrix	Recovery within 25% of expected value	Correct problem, re-analyze
	Duplicate	Each analytical batch	For each analyte, <20% RPD	Correct problem, re-analyze duplicate pair
	Reporting Limit Verification Standard	Immediately following initial calibration and prior to the analysis of any samples	All analytes within calculated ranges	Re-analyze, re-analyze initial calibration or flag appropriately

Table A-7 Summary of Calibration and QC Procedures for Metals by GFAA

Method Reference	QC Check	Frequency	Acceptance Criteria	Corrective Action
EPA Methods 202.2, 204.4, 206.2, 210.2, 213.2, 218.2, 220.2, 239.2, 243.2, 246.2, 249.2, 270.2, 272.2, 279.2, 282.2, 286.2, 200.9 **SW-846 Methods: 7020, 7040, 7041, 7061, 7080, 7091, 7131A, 7140, 7191, 7200, 7210, 7380, 7421, 7450, 7460, 7480, 7520, 7610, 7740, 7760, 7770, 7841, 7870, 7911, 7950**	Initial Calibration (ICAL)(minimum 3 standards and a reagent blank)	Daily initial calibration prior to sample analysis	Correlation coefficient >0.995 for linear regression	Correct problem, repeat initial calibration
	Calibration Blank	Once per ICAL	No analyses detected >RL	Correct problem and repeat ICAL
	Continuing calibration verification	Immediately following the initial calibration blank, after every 20 samples and at the end of the analytical sequence	Initial CCV , all analytes within %5[6] of expected value, all CCV' after this, within 10% of expected value	Correct problem, re-analyze CCV and repeat all samples since last successful CCV
	Initial Calibration Verification	Immediately following calibration blank and prior to the analysis of other QC and all samples	All analytes within 10% of expected value	Repeat analysis; if ICV still fails acceptance criteria then correct problem, repeat ICAL, initial CCV, calibration blank and ICV
	Method Blank	One per preparation batch	No analyses >RL	Re-analyze prep blank; if blank still fails, correct problem then re-prep entire batch and re-analyze
	LCS	One per prep batch	See Table 5-6, 5-13	Re-analyze LCS; if LCS still does not meet acceptance criteria, re-prep batch
	Duplicate	One per 20 samples	See Tables 5-6, 5-13	Re-analyze duplicate pair; if duplicates still do not meet acceptance criteria, flag data accordingly
	Analytical Spike	One per 20 samples	All analytes within 20% of expected value	Re-analyze; if analytical spike fails acceptance criteria, repeat analytical sequence
	MS/MSD	One per preparation batch	See Tables 5-6, 5-13	Flag data for failed MS or MSD recovery or failed RPD

[6] 5% criteria applicable only to drinking waters; otherwise initial CCV need only be within 10% of the expected value

Table A-7 Summary of Calibration and QC Procedures for Metals by GFAA (Con't)

Method Reference	QC Check	Frequency	Acceptance Criteria	Corrective Action
EPA Methods 202.2, 204.4, 206.2, 210.2, 213.2, 218.2, 220.2, 239.2, 243.2, 246.2, 249.2, 270.2, 272.2, 279.2, 282.2, 286.2, 200.9 **SW-846 Methods: 7020, 7040, 7041, 7061, 7080, 7091, 7131A, 7140, 7191, 7200, 7210, 7380, 7421, 7450, 7460, 7480, 7520, 7610, 7740, 7760, 7770, 7841, 7870, 7911, 7950**	Reporting Limit Verification Standard	Immediately following initial calibration and prior to the analysis of any samples	All analytes within calculated range	Re-analyze, re-analyze initial calibration or flag appropriately

Table A-8 Summary of Calibration and QC Procedures for Mercury by CVAA

Method Reference	QC Check	Frequency	Acceptance Criteria	Corrective Action
EPA 245.2, 245.5 **SW 846 7470 A, 7471 A**	Initial Calibration (ICAL)(minimum 3 standards and a reagent blank)	Daily initial calibration prior to sample analysis	Correlation coefficient >0.995 for linear regression	Correct problem, repeat initial calibration
	Linear Dynamic Range (3 Standards)	Annually	Within 10% of expected value	Calibration range lowered to meet LDR result
	Calibration Blank	Immediately following the initial calibration, once every 10 samples and at end of analytical sequence	<RL	Re-analyze blank; if blank still fails acceptance criteria, correct problem and repeat all samples analyzed since the last acceptable blank
	Continuing Calibration Verification (CCV)	Immediately following the initial calibration blank, after every 10 samples and at the end of the analytical sequence	Initial CCV , all analytes within %5 of expected value, all CCV' after this, within 10% of expected value	Re-analyze CCV; If CCV still fails acceptance criteria, correct problem and repeat all samples since last successful CCV

Table A-8 Summary of Calibration and QC Procedures for Mercury by CVAA (Con't)				
Method Reference	**QC Check**	**Frequency**	**Acceptance Criteria**	**Corrective Action**
EPA 245.2, 245.5 SW 846 7470 A, 7471 A	Initial calibration verification (ICV)	Once, prior to sample analyses	Within 10% of expected value	Repeat analysis; if ICV still fails acceptance criteria then correct problem, repeat ICAL, initial CCV, calibration blank and ICV
	Method Blank	One per preparation batch	No analyses >RL	Re-analyze prep blank; if blank still fails, correct problem then flag data appropriately
	LCS	One per preparation batch	See Table 5-6, 5-13	Re-analyze LCS; if LCS still does not meet acceptance criteria, re-prep batch
	MS/MSD	One per preparation batch	See Tables 5-6, 5-13	Flag data for failed MS or MSD recovery or failed RPD

Table A-9 Summary of Calibration and QC Procedures for Semi-Automated Spectrophotometric Analyses				
Method Reference	**QC Check**	**Frequency**	**Acceptance Criteria**	**Corrective Action**
SM 4500- Cl E EPA 335.4 EPA 335.3 EPA 351.2 EPA 353.2 EPA 420.2 SM 5310 C	Initial Calibration (ICAL)(minimum 5 standards and a reagent blank)	Daily initial calibration prior to sample analysis	Correlation coefficient >0.995 for linear regression	Correct problem, repeat initial calibration
	Initial calibration verification (ICV)	Once, prior to sample analyses and immediately following ICAL	Within 10% of expected value	Repeat analysis; if ICV still fails acceptance criteria then correct problem, repeat ICAL, initial CCV, calibration blank and ICV
	Reagent Blank	Immediately following ICAL, every 10 samples and at end of analytical batch	<RL	Repeat analysis; if blank still fails acceptance criteria, correct problem and re-start analytical sequence
	Continuing calibration verification	Immediately following the ICV, prior to sample analyses, every 10 samples and at end of analytical batch	Within 10% of expected value	Repeat CCV; if CCV still fails acceptance criteria, correct problem, restart analytical sequence and repeat all samples analyzed since last acceptable CCV
	Method Blank	One per preparation batch	No analyses >RL	Re-analyze prep blank; if blank still fails, correct problem then re-prep entire batch and re-analyze

Table A-9 Summary of Calibration and QC Procedures for Semi-Automated Spectrophotometric Analyses (Con't)				
Method Reference	**QC Check**	**Frequency**	**Acceptance Criteria**	**Corrective Action**
SM 4500- Cl E EPA 335.4 EPA 335.3 EPA 351.2 EPA 353.2 EPA 420.2 SM 5310 C	LCS[7]	One per prep batch	See Tables 5-1, 5-5,5-12	Re-analyze LCS; if LCS still fails acceptance criteria, correct problem and re-prep entire batch or flag data accordingly
	MS/MSD	One per 20	See Tables 5-1, 5-5,5-12	Flag data for failed MS or MSD recovery or failed RPD
	LDR	Annually	Within 10% of expected value	Calibration range altered to meet LDR result

Table A-10 Summary of Calibration and QC Procedures for Titrimetric Analyses				
Method Reference	**QC Check**	**Frequency**	**Acceptance Criteria**	**Corrective Action**
SM 2310 B SM 2320 B SM 4500-Cl C EPA 130.2 EPA 215.2 SM 4500- NH_3 E EPA 376.1 EPA 377.1 SW 9020 B	LCS	One per preparation batch	See Tables 5-1, 5-5,5-12	Re-analyze LCS; if LCS still fails acceptance criteria, re-prepare entire batch
	Method Blank	One per preparation batch	<RL	Re-analyze Method Blank; if Method Blank still fails acceptance criteria, re-prepare entire batch
	MS/MSD	One per preparation batch	See Tables 5-1, 5-5,5-12	Flag data for failed MS or MSD recovery or failed RPD
	Independent calibration verification (ICV)	Quarterly	Within 10% of expected value or within stated acceptance ranges	Repeat ICV; if ICV still fails acceptance criteria, prepare another ICV from fresh standard materials

[7] Method SM 5310 C does not require an LCS

Table A-11 Summary of Calibration and QC Procedures for Colorimetric Analyses

Method Reference	QC Check	Frequency	Acceptance Criteria	Corrective Action
EPA 330.5 SM 3500-Cr D EPA 353.3 SM 4500-NO_3 E SM 4500-Si D	Initial calibration (ICAL) (Minimum 5 standards)	Daily initial calibration prior to sample analysis	Linear correlation coefficient >0.995	Correct problem, repeat ICAL
	Initial calibration verification (ICV)	Immediately following ICAL analysis and prior to sample analysis	Within 10% of expected value	Repeat ICV; If ICV still fails acceptance criteria, correct problem and repeat ICAL and ICV
	Continuing Calibration Verification (CCV)	Prior to sample Analysis	Within 10% of expected Value	Repeat CCV; If CCV still fails acceptance criteria, correct problem and repeat ICAL ,ICV and CCV
	Method Blank	One per preparation batch	<RL	Repeat Method Blank; If Method Blank still fails acceptance criteria, correct problem and re-prepare batch
	LCS	One per preparation batch	See Tables 5-5,5-12	Repeat LCS; If LCS still fails acceptance criteria, correct problem and re-prepare batch
	MS/MSD	One per preparation batch	See Tables 5-5,5-12	Flag data for failed MS or MSD recovery or failed RPD

Table A-12 Summary of Calibration and QC Procedures for Gravimetric Analyses

Method Reference	QC Check	Frequency	Acceptance Criteria	Corrective Action
SM 5520 B, D SM 2540 C USGS I-3765-85 SM 2540 G EPA 160.4	Check scale calibration with 5 masses	Daily, prior to sample analysis	See SOP CF07-01	Run calibration procedure on balance
	LCS	One per preparation batch	See Tables 5-1, 5-5,5-12	Repeat LCS; If LCS still fails acceptance criteria, correct problem and re-prepare batch
	Method Blank	One per preparation batch	<RL	Repeat Method Blank; If Method Blank still fails acceptance criteria, correct problem and re-prepare batch

Table A-12 Summary of Calibration and QC Procedures for Gravimetric Analyses (Con't)				
Method Reference	**QC Check**	**Frequency**	**Acceptance Criteria**	**Corrective Action**
SM 5520 B, D **SM 2540 C** **USGS I-3765-85** **SM 2540 G** **EPA 160.4**[8]	Duplicates	One per preparation batch	See Tables 5-1, 5-5,5-12	Re-analyze duplicate pair; if duplicates still do not meet acceptance criteria, flag data accordingly

Table A-13 Summary of Calibration and QC Procedures for Electrometric (Ion Specific Electrode) Analyses				
Method Reference	**QC Check**	**Frequency**	**Acceptance Criteria**	**Corrective Action**
EPA 150.1 **SM 2510 B** **SM 4500-NO_3 D** **SM 4500-F C** **SM 4500-NH_3 F**	Initial calibration (ICAL) (Minimum 3 standards)	Daily initial calibration prior to sample analysis(for pH EPA 150.1, the ICAL is performed prior to each batch of samples)	Slope between -54 and -60[9]	Correct problem, repeat ICAL
	Initial calibration verification (ICV)	Immediately following ICAL analysis and prior to sample analysis	Within 10% of expected value[10]	Repeat ICV; If ICV still fails acceptance criteria, correct problem and repeat ICAL and ICV
	Continuing Calibration Verification (CCV)	Prior to sample Analysis and Every 10 Samples	Within 10% of expected Value	Repeat CCV; If CCV still fails acceptance criteria, correct problem and repeat ICAL ,ICV and CCV
	Method Blank	One per preparation batch	pH 5.5 –7.5 units; Conductivity < 2; all others <RL	Repeat Method Blank; If Method Blank still fails acceptance criteria, correct problem and re-prepare batch
	LCS	One per preparation batch	Only fluoride by SM 4500-F B,C has an LCS; Criteria is ± 20% of expected Value	Repeat LCS; If Method Blank still fails acceptance criteria, correct problem and re-prepare batch
	MS/MSD	One per preparation batch	See Tables 5-5,5-12	Flag data for failed MS or MSD recovery or failed RPD

[8] This test requires a duplicate only
[9] There is no ICAL for Specific Conductivity method
[10] For pH by EPA 150.1 the CCV criteria is ± 0.1 Units

Table A-14 List of Excepted Compounds for SW 8260 B ICAL and CCV Criteria

Acetone	1,3-cis-Dichloropropene	Methyl Ethyl Ketone (MEK)
2,2-Dichloropropane	2-Chloroethylvinyl ehter	Methyl isobutyl ketone (MIBK)
2-Hexanone	t-Butanol	Naphthalene
Acrolein	1,3-trans- Dichloropropene	Tetrhydrofuran
Acrylonitrile	t-Butylethyl Ether	Trans-1,4-Dichoro-2-Butene
Bromomethane	t-Amylmethyl Ether	2-Hexanone
Chloromethane	Hexane	1,2-Dibromo-3-Chlorophenol
Heptane	Iodomethane	Vinyl Acetate
Hexachlorobutadiene	Methylene Chloride	1,2,3-Trichlorobenzene
Ethanol	Methyl Acetate	

Table A-15 List of Excepted Compounds for SW 8270 C ICAL and CCV Criteria

Benzidine	4-Chloroaniline
2,4-Dinitrophenol	4-Nitroaniline
2,5-Dinitrophenol	4-Nitrophenol
2-Nitroaniline	Benzoic Acid
3,3'-Dichlorobenzidine	Benzyl Alcohol
3-Nitroaniline	Bis-2-Ethylhexylphthalate
4,6-Dinitro-2-Methylphenol	4-Chloro-3-methylphenol

APPENDIX C

Matrix Environmental Quality Assurance Program and
Standard Operating Procedure

QUALITY ASSURANCE PROGRAM

MATRIX ENVIRONMENTAL, LLC

August, 2005

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The Quality Assurance Program Manual's
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QUALITY ASSURANCE PROGRAM, Matrix Environmental, LLC

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QUALITY ASSURANCE PROGRAM, Matrix Environmental, LLC

TABLE OF CONTENTS

SECTION TITLE

TABLE OF CONTENTS
(continued)

SECTION TITLE

QUALITY ASSURANCE PROGRAM

1.0 INTRODUCTION

1.1 GENERAL

Matrix Environmental, LLC. (Matrix) is an environmental service company serving the upper Midwest and Ohio River Valley region in specialized sampling techniques and mobile laboratory analysis. The purpose of the Matrix Quality Assurance Program is to assure that the quality of service that our clients receive both in the sampling and analytical areas of the company achieve the high standards of quality we have set for ourselves. In an effort to meet this quality of work Matrix uses the newest technologies, high quality equipment, and well-trained personnel.

1.2 QUALITY ASSURANCE OBJECTIVES

The goal of our quality assurance program is to ensure that the production of samples and data are of known quality. This requires a comprehensive and effective quality control program to measure the validity of our performance and the use of approved or proven methods to produce data that is accurate, precise, complete and meets our clients needs. The system must also be able to identify factors or areas that adversely affect quality and aid in the maintenance of them.

Specifically, the quality assurance program addresses the following topics:

A. Equipment/instrument calibration and preventative maintenance.
B. Statistical analysis of quality control data.
C. Data validation and reporting.
D. Field and laboratory records.
E. Staff training.

1.3 QUALITY ASSURANCE DOCUMENTS

There are several types of quality assurance documents.

A. The Quality Assurance Manual provides an overall policy for the company.

B. Standard Operating Procedures (SOPs) are detailed instructions covering a specific analytical method or routine task.

C. Project specific manuals may be prepared where a project requires unique or different quality assurance requirements or when they are required by regulatory agencies. These documents are called Quality Assurance Project Plans (QAPP).

1.4 DOCUMENT CONTROL

All of the quality assurance documents listed above shall be approved and controlled documents as spelled out in this paragraph. The Quality Control Coordinator shall review and update the Quality Assurance Manual on an annual basis or as needed. The Quality Assurance Manual shall require the approval of the President before changes are issued. SOPs shall be authorized by the Quality Control Coordinator and the President and approved by the appropriate Manager.

2.0 MATRIX ORGANIZATION

2.1 QUALITY RESPONSIBILITIES

The quality assurance responsibilities of the Matrix staff are listed below:

2.1.1 Operations Manager

- Oversees all operations and approves all additions to Quality Assurance/Quality Control Program, SOPs, and project specific quality plans.
- Approves all laboratory and sampling reports.
- Evaluates new technologies, equipment, and procedures and makes recommendations to chemists and quality control officer.
- Supervises the training of sampling personnel to ensure their compliance with Matrix's SOPs and company quality control procedures.
- Oversees the maintenance of all sampling and laboratory equipment to ensure proper preventative maintenance is performed in a timely manner.
- Organizes scheduling of projects to ensure that adequate preparation time is allocated so that all quality assurance procedures can be performed.
- Reviews quality control data and evaluates all control samples.

2.1.2 Quality Control Officer

- Reports directly to Operations Manager.
- Implements Quality Assurance/Quality Control Program within the laboratory and periodically determines its effectiveness.
- Reviews all reports submitted by the laboratory.
- Reviews all quality control data and ensures proper procedures and calculations were performed. Directs the corrective actions to be taken out for data outside of control limits.
- Provides technical overview of the laboratory including equipment, standards, gasses, procedures, SOPs, and implementation of new methodologies.
- Supervises the training of all individuals in the proper use and maintenance of equipment, and ensures that all Matrix SOPs and quality control procedures are being followed.
- Reviews all analytical data for completeness and accuracy.

2.1.2 Quality Control Officer (continued)

- Implements and maintains data verification procedures.
- Performs statistical analysis of quality control data.
- Reviews the data and implements changes according to quality control procedures.
- Supervises accreditation and proficiency programs.
- Defines and implements preventative maintenance programs for all analytical instrumentation.

2.1.3 Environmental Chemist

- Perform analytical procedures and data recording in accordance to Matrix's SOPs.
- Validate and document data according to Quality Assurance/Quality Control Program specifications.
- Report all deviations from quality such as, out of limits, instrument problems, calibration failures, and perform all necessary corrections to these deviations.
- Perform all preventative maintenance on all analytical equipment as defined by the Quality Control Officer.

2.1.4 Sampling Technician

- Perform all sampling procedures in accordance with Matrix's SOPs and quality assurance data.
- Keep all equipment free of contaminants in accordance with Matrix's SOPs.
- Perform all preventative maintenance as outlined by the operations manager.

2.2 PERSONNEL FILES

Personnel Files are maintained for each employee in a centralized location. The files are divided into two sections:

2.2.1 Qualifications/Certifications

2.2.1.1 Resume

A current resume for each employee is maintained in the files and updated as required. Resumes for key individuals are listed in Section 2.0, Matrix Organization/Personnel.

2.2.1.2 Job Descriptions/Responsibilities

Current job descriptions outlining specific duties and responsibilities are included in Section 2.0, Matrix Organization/Personnel.

2.2.1.3 Training Log

A training log outlining all training activities including on-the-job-training are kept and maintained by each employee. Completed logs are archived in the personnel file after review and signature by his supervisor.

2.2.2 ADMINISTRATIVE DOCUMENTATION

2.2.2.1 Reviews

Performance reviews are given on an annual basis. The written review requires input from both the staff and their supervisor and is designed to positively direct each individual's career and to implement growth and change from within the organization.

2.2.2.2 Salary Actions

Salary reviews are performed annually or as required due to changes in status. These changes are documented on an employee status change form.

2.3 MATRIX ORGANIZATION/KEY PERSONNEL RESUMES

Employee	Title
James Dzubay	President/Operations Manager (MN)
Daniel Pipp	Operations Manger/Environmental Chemist (MN)
Mike Jenson	Quality Assurance Officer, Chemist (MN)
Pat Tuzinski	Chemist (MN)
Andy Kirsch	Operations Manager, Chemist (OH)
Bob Giddings	Environmental Technician (MN)
Guy Paquette	Driller, Sampling Technician (MN)
Dan Thompson	Sampling Technician, Geologist (MN)

RESUME

James D. Dzubay, M.S.

EDUCATION:

Masters of Science, Water Resources Management (Hydrogeology Emphasis) - 1990
University of Wisconsin - Madison, Madison, Wisconsin

Bachelor of Arts, Geology - 1988
Gustavus Adolphus College, St. Peter, Minnesota

PROFESSIONAL WORK EXPERIENCE:

Matrix Technologies, Inc., Osseo, MN — 1993-present
Operations Manager/President

- ♦ Responsible for day to day operations of Osseo, MN and Columbus, OH offices.
- ♦ Oversee/manage client services including; ground water monitoring & sampling, direct push sampling, and mobile laboratory.

Delta Environmental Consultants, Inc., St. Paul, MN — 1990-93
Project Manager

- ♦ Management of 25 to 30 site characterization projects including UST, Ag-Chem, and RCRA sites.
- ♦ Assisted with the management of national oil company account.

Wisconsin Department of Natural Resources, Madison, WI — 1989-90
Project Coordinator

- ♦ Managed environmental compliance programs at WDNR facilities (i.e. annual budget of $750,000.00)
- ♦ Worked with consultants and regulators on site characterization projects at WDNR facilities.
- ♦ Coordinated statewide tank removal program (i.e. 375 tanks) at over 100 WDNR facilities.

PROFESSIONAL MEMBERSHIPS:

- National Ground Water Association
- Minnesota & Wisconsin Ground Water Associations

RESUME
Daniel A. Pipp

EDUCATION:
Bachelor of Science, Water Resources, Chemistry - 1993
University of Wisconsin-Stevens Point

PROFESSIONAL WORK EXPERIENCE:
Matrix Environmental, LLC., Osseo, MN 1995-present
Operations Manager/Senior Chemist
- Responsible for project coordination, reporting, and scheduling.
- Responsible for the use and maintenance of the membrane interface probe and electrical conductivity equipment.
- Responsible for the analysis of volatile organic compounds by purge and trap GC/PID/FID/XSD. Modified EPA methods for PVOCs, VOCs, PAHs, metals, Chlorinated Pesticides, Soil Gas.
- Responsible for the maintenance and calibration of instruments and detectors; generation and review of raw data.
- Preparation and review of method Standard Operating Procedures.
- Maintain internal Quality Control, internal audits; maintain laboratory chemicals and standard supply.

HUNTINGDON ENGINEERING & ENVIRONMENTAL INC., St. Paul, MN 1993-95
Senior Volatiles Chemist
- Responsible for the analysis of volatile organic compounds by purge and trap GC/PID/ELCD as specified in EPA Methods 601/602, 8010/8020, 8021, and 465.
- Maintenance and calibration of instruments and detectors; preparation of chemical standards for analysis; generation and review of raw data.
- Analytical Service Coordinator; prepared and reviewed method Standard Operating Procedures; maintained laboratory chemicals and standards supply.

ENVIRONMENTAL TASK FORCE, UWSP Stevens Point, WI 1990-93
Environmental Chemist
- Organic experience included extraction of soil and water matrices for EPA methods 507, 608, 8021, 8270 and Wisconsin DNR modified DRO and GRO analysis.
- Instrumentation experience included gas chromatography, purge and trap, atomic absorption, gel permeation, ion chromatography, and infrared and mass spectrometry.
- Inorganic experience includes pH, conductivity, hardness, alkalinity, and metal analysis.

RESUME
Michael Jenson

EDUCATION:
Bachelor of Science, Biochemistry - 1991
University of Minnesota

PROFESSIONAL WORK EXPERIENCE:
Matrix Environmental, LLC., Osseo, MN 1999-present
Senior Chemist/Quality Assurance Officer
- Responsible for the analysis of volatile organic compounds by purge and trap GC/PID/FID/XSD. Modified EPA methods for PVOCs, VOCs, PAHs, metals, Chlorinated Pesticides, Soil Gas.
- Responsible for the maintenance and calibration of instruments and detectors; generation and review of raw data.
- Preparation and review of method Standard Operating Procedures.
- Development of Quality Assurance manual, maintain internal Quality Control, maintain laboratory chemicals and standard supply.

Quantech Ltd. 1995-1997
Senior Research Assistant
- Developed positive control assay used for demonstrating final coated. Product stability and functionality.
- Developed and wrote R&D functionality test procedures to verify coating protocol for prototypes.
- Developed and configured twenty infectious disease ELISA kits.
- Designed and performed experiments and technical protocols to investigate instrument and transducer components of the biosensor system.
- Designed and optimized procedures for manufacture of immunoassays.

INCSTAR Corp. 1991-95
Product Support Technician
- Developed an optimized gold substrate coating procedure for surrogate chemistry system.
- Collected and analyzed stability data to define raw material specifications for new and existing products.

3.0 HEALTH AND SAFETY

3.1 OSHA 40 HOUR TRAINING

All of Matrix's employees are required to complete a certified OSHA 40-hour hazardous materials training course. All field personnel are also required to complete the yearly 8-hour OSHA refresher course. A copy of each employee's certification is kept by Matrix Management. Listings of these certifications shall be enclosed in all proposals and copies of these certifications are available upon request.

3.2 MEDICAL MONITORING PROGRAM

All employees are required to partake in a yearly medical monitoring program. Each employee has an exam prior to starting with Matrix to gain background information. This yearly exam evaluates the impact that the field work has on the employees.

3.3 PROTECTIVE CLOTHING

All of Matrix's field employees will follow basic health and safety precautions while on site. This includes the use of ear protection, safety glasses and gloves. Also, every Matrix vehicle shall contain hard hats, reflective traffic vests and traffic cones for use at the project site when needed. Tyvek suits and respirators will be brought to the project site upon the request of the client and supplement of further health and safety information concerning expectant contamination compounds and levels.

3.4 RESPIRATORY PROTECTION PLAN

Matrix field employees have all gone through the respirator fit test and will bring respirators along to the job site when requested by the client.

3.5 PERSONNEL EXPOSURE MONITORING

When at a project site where contaminant levels are nearing the IDLH and TLV our employees will require that the surrounding air is continuously monitored and if they feel in danger they may refuse to continue until proper protective clothing is present.

4.0 FACILITIES

Matrix owns and operates 7 Geoprobe® sampling units. One is an Advance 6600 unit mounted on a Ford F-550 4-wheel drive vehicle. Another Advance unit, a 6610DT, is a track-mounted probe ideal for all terrain and limited access. We have four 5400 probes, one is mounted on a Bobcat® for sites with limited access. Two are mounted on Ford F-250 4-wheel drive pick-ups and the last is a dolly-mounted rig for extremely limited access situations. The laboratory equipment used for sample analyses is housed in a pull behind trailer, which is then separated at the job site. Matrix also owns hand-probing equipment used for special applications.

4.1 SAMPLING AREA

The sampling units are sufficiently separated from the laboratory areas to limit interference with the analytical equipment. The sampling area also contains storage racks for the probing rods, sample collection equipment, and soil-gas sampling vacuum pump.

4.2 LABORATORY AREA

Located separately, the laboratory is sufficiently removed from potential inteferences from the sampling probe unit. The analytical system is vented out of the laboratory area to limit possible chemical interference.

4.3 ANALYTICAL STANDARDS AREA

Analytical standards are received, logged in, and placed in a storage refrigerator free of contamination and containing no other potentials for inferences. Standards are maintained at a temperature of 2°C-6°C or colder. The temperature of both the office and laboratory standard storage areas are monitored and documented on temperature charts.

4.4 OFFICE SPACE

Matrix's headquarters is at 8631 Jefferson Hwy. in Osseo, MN. The facility has 1,000 square feet of office space and an adjoining 3,000 square feet of warehouse space.

Matrix's Ohio office is located at 72 Holmes St. in Galena, Ohio. The facility has 500 square feet of office space and adjoining 1,000 square feet of warehouse space.

5.0 LABORATORY EQUIPMENT

5.1 CALIBRATION AND MAINTENANCE

Equipment calibration is required to demonstrate that the equipment is operating properly. Proper operation is critical to achieve desired sensitivity and establishing detection limits.

The calibration type used for analytical equipment is the standard curve. The type of standard curve used is based on detector response, client requirements, and analyst's judgement. Calibrations shall be done prior to start of the instrument usage for the work intended. Calibrations will be checked prior to work performed and throughout the project.

Actual calibration requirements are contained in the SOPs specific to each instrument or analytical method.

Operational Calibrations

As previously mentioned, operational calibration involves preparing a standard curve. Operational calibration guidelines for the analytical equipment in Matrix's laboratories include the following:

1. The analyst shall eliminate, or minimize, the source of errors by proper selection of analytical method, equipment, standards, solvents and gases. Since even the best quality materials may contain interfering substances, the analyst will analyze a method blank.

2. The method blank shall be prepared following the procedure step-by-step, including the addition of all solvents and reagents in quantities specific to the method. If this method blank interferes with the quantification of target analytes, steps shall be taken to reduce or eliminate the interferences. If this cannot be done, the magnitude of the interference shall be considered when quantifying the concentration of the target analyte. A method blank shall be run at the beginning of each analysis day. A blank is also run if a highly contaminated sample is analyzed and sample carryover is a possibility. In the case of purge and trap analysis, a blank consists of five (5) milliliters of deionized water with a surrogate standard added; and for vapor sampling, a blank consists of ambient air taken directly from the vapor sample tubing.

3. Preparation of a standard curve for the gas chromatograph will consist of at least a three-point calibration prepared by plotting instrument response versus concentration of the compound analyzed so that sample concentrations can be determined. The concentrations of these standards in the calibration curve shall cover the working range of the instrument and sample measurement shall be made within this range if the data is to be acceptable. A calibration coefficient of 0.995 or better is required for the calibration to be acceptable. Records of these calibrations can be obtained directly with the sample data, as each sample run is saved with its characteristic calibration curve for each analyte electronically. Calibration acceptance criteria can be found in the method specific SOPs.

4. Standards are assigned a number in the standard preparation logbook and designated either a Stock Standard and labeled as ST#- (stored in a vial with a red cap after opening) or Working Standards designated as WS#- (stored in a vial with a blue cap) or a Calibration Standard designated as CS#- (stored in a vial with a green cap). Information that is recorded in the logbook includes: description, manufacturers lot number, volume, date stock standards are opened, preparation dates and volumes of working standards, verification check off box. All standards are NIST traceable and verified upon receipt with a second source standard prior to fielding. Standard may not be fielded if the composition or concentration is not that which is stated on the manufacturers certificate of analysis.

5.2 PREVENTATIVE MAINTENANCE

Preventative maintenance shall be performed routinely to maintain proper performance of instruments and equipment and to prevent the failure of instruments and equipment. Designated personnel are trained in most preventative maintenance procedures. This shall consider all instruments, equipment, and other parts subject to deterioration; spare parts should be available to minimize downtime and the frequency which maintenance is required. Preventative maintenance schedules are kept and any maintenance events are recorded in logbooks. These schedules are specific to each piece of equipment, and are based on manufacturers specifications.

6.0 MANAGEMENT SYSTEMS

6.1 STANDARD OPERATING PROCEDURES (SOPS)

SOPs shall be developed and implemented for all routine, standardized, or special/critical operations. SOPs have been divided into four groups, which are contained in two volumes, to reflect the different operations as outlined below:

6.1.1 General Operations Manual (Volume I)

This group contains the SOPs required for daily operation of office and business functions, including QA activities.

6.1.2 Equipment Manual (Volume I)

This group contains the SOPs required for the use of field and laboratory equipment.

6.1.3 Laboratory Operations Manual (Volume II)

This group contains the SOPs required for all facets of lab operations including calibration and specific procedures.

6.1.4 Field Operations Manual (Volume II)

This group contains the SOPs required for all facets of field operations. SOPs are updated and re-issued as required and are re-evaluated every two years, or more frequently when changes have been made to references or procedures. A master SOP index/file maintains a record of each SOP, review dates, changes, modifications, and copies of each issue. Each SOP manual is a controlled document assigned to a specific location to provide staff accessibility.

6.2 FORMS

Forms are developed to aid in the documentation process and to be used with SOPs. Each form is assigned a unique number under its specific group and an issue date and contains blanks or lines to be filled in by the appropriate personnel. When a form is reviewed and changes are made, the date changes to reflect the date of change. A master form index maintains a record of each form and its issue date. Examples of forms used by MATRIX are included in Appendix A. Forms have been divided into the following categories:

6.2.1 General (GEN)

This group contains forms which are generally used by everyone in the company.

6.2.2 Equipment (EQP)

This group contains forms related to equipment use.

6.2.3 Field (FLD)

This group contains forms related to fieldwork

6.2.4 Laboratory (LAB)

This group contains forms related to laboratory operations.

A. <u>Sample Control Form # LAB-A1</u>
A sample control form serves as documentation for sample collection and laboratory analysis. This form is part of Matrix's internal quality control of sample handling and analysis as well as being used as a reference for future retrieval of archived data. Information included on this document: date, page #, project #, project name, chemist, client, check-off box for when sample is analyzed, sample I.D, description, date/time sampled, date/time analyzed, amount analyzed, dilution, chromatogram file I.D #, notes section to include sample condition upon receipt, temperature of refrigerator (or cooler).

B. <u>Results Form # LAB-B1,-B2,-C1 & -C2</u>
These forms identify all compounds found in each sample by listing every sample that was analyzed and the respective concentrations [in ug/L (ppb) for waters and mg/kg (ppm) for soils] of compounds found in each sample. This form also contains a key which identifies any flags (additional information/problems about the sample/analysis). Water and soil forms are separate, as are (VOC +BTEX) and PVOC forms. All answers recorded on these forms are the final results, needing no dilution or other adjustments.

6.2.4 **Laboratory (LAB)** (continued)

C. QA/QC Data Form # LAB-D1 and LAB-D2
These forms contain all matrix spike, matrix spike duplicate, relative percent difference, and mobile laboratory refrigerator (or cooler) temperature monitoring information.

D. Stock Standard Form # LAB-E1
This form contains information pertinent to purchased stock standards including: vendor, description, vendor lot #, I.D.# (MATRIX lot #, designated ST #-)date received, date opened, volume, concentration and solvent of standard, storage location, mfg. expiration date, box to be initialed after standard's composition and concentration are verified by a second source vendor.

E. Working Standard Form # LAB-E2
This form contains information pertinent to secondary standards (dilution of stock standard with P & T grade methanol) of BFB (surrogate std), VOC mixes, PVOC/BTEX mixes, fuel oil # 2, and other compounds as needed for matrix spikes, surrogate spikes, and continuing calibration spikes. Information included is as follows: I.D.# (MATRIX lot #, designated as WS#-), stock std.used, dilution of stock std, final concentration and solvent of secondary std, storage location, date prepared, exp. date, and chemist's initials.

F. Calibration Standard Form # LAB-E3
This form contains information pertinent to secondary standards (dilution of stock standard with P & T grade methanol) of BFB (surrogate std), VOC mixes, PVOC/BTEX mixes, fuel oil # 2, and other compounds as needed for calibrating the instruments. Information included is as follows: I.D.# (MATRIX lot #, designated as CS#-), stock std .used, dilution of stock std, final concentration and solvent of secondary std, storage location, date prepared, exp. date, and chemist's initials.

G. PID Lamp Form # LAB H-1
This form is used for tracking PID bulb information (from installation to removal) including: date installed, bulb serial and lot #, cleaning schedule, log of hours, and bulb sensitivity. This form is posted on the laboratory bulletin board.

H. Instrument Change Form # LAB-I1
This form is used (in addition to the lab maintenance log book) to highlight at a glance, all major work done on any and all components of the analytical system. This form is posted on the laboratory bulletin board.

6.2.4 **Laboratory (LAB)** (continued)

I. QC Standard/Sample Temperature Monitor Form # LAB-F1
This form is for periodic recording the office sample/standard refrigerator and freezer temperatures. It will be posted on the refrigerator/freezer. Completed forms will be stored in the office in a folder with the NIST certificate.

J. QC Analytical Scale Check Form # LAB-G1
These forms are for the periodic QC checks of the analytical balances in the labs. These forms will be posted on the lab bulletin board. Completed forms will be stored in the office with the NIST weight certificates.

6.3 PURCHASING

Purchasing is processed through MATRIX's Management staff. All purchases require a valid purchase order number. The purchasing process documents the order placed, provides for procurement source evaluation and selection evaluation of supplier quality, and receipt inspections.

6.3.1 Vendor Listing
Management maintains a listing of vendors. Vendors are added or subtracted from this listing based on a review of adherence to material specifications and a need for additional vendors supplying specific items.

6.4 DOCUMENT CONTROL

6.4.1 Project Files
Separate record packages are maintained for each project and are filed according to project number. Project files are maintained in a controlled area.

Completed and closed files are transferred to a file storage area. Retrieval of closed files is by sign out through the Management Department. Closed files shall be maintained for a minimum of three years, unless otherwise requested by the client.

6.4.2 Laboratory Records

Laboratory records fall into two major categories:

- Documents which reflect overall laboratory operation such as instrument log books and QC forms.

- Documents which are specific to a group of samples or project such as raw analytical data.

All laboratory records from time of sample receipt through data reporting shall be available if requested by the client, an authorized regulatory agency, or court. No other outside person or persons shall have access to the laboratory files without written permission from the client.

6.4.3 General Laboratory Operations Records
The following records shall be maintained by the laboratory and/or Quality Control (QC) Coordinator.

6.4.3.1 Instrument Maintenance Logs - A separate log shall be maintained for each instrument listing all maintenance performed in-house or by outside groups. These logs shall be maintained in the laboratory during use and then archived with the QC Coordinator.

6.4.3.2 Performance Evaluation Records - A record of all performance evaluations shall be maintained by the QC Coordinator.

6.4.3.3 Certification Program Records - Records shall be maintained by the QC Coordinator of all analytical data, agency results and certification of performance from all certification programs.

6.4.3.4 Training Records - Resumes, external training, and in-house training records shall be maintained alphabetically by name of employee in the employee file.

6.4.3.5 Instrument Run/Calibration Log - A list of samples run on each instrument as well as all calibrations shall be maintained in this logbook and maintained by the analysts.

6.4.3.6 Standard Operating Procedures - A file of current and historical laboratory SOPs with issue dates shall be maintained by the QC Coordinator. A complete collection of all SOPs shall be kept in each laboratory.

6.4.3.7 QC Manual - This manual will be placed in all labs and in all offices and be maintained by the QC Coordinator. The manual shall be signed and dated by the author, QC Coordinator, and President.

6.4.3.8 Table I - This table contains a list of all compounds, their retention times and their reporting limits.

7.0 DRILLING OPERATIONS

7.1 SAMPLE COLLECTION

Sample collection is performed with different types of equipment and different procedures dependent upon the sample matrix. These procedures are outlined further in Matrix's sample collection Standard Operating Procedure (SOP).

7.2 SAMPLE HANDLING

Samples are collected by the sampling technician, and immediately transferred to the laboratory portion of the Geoprobe® unit in a certified sample container. This makes preservation unnecessary and reduces the potential of contamination arising from any preservative added. It also minimizes any volatilization of analytes and reduces the risks of false negatives. In the event the sample must be held for any length of time prior to analysis due to equipment limitations, proper short-term preservation techniques will be applied until the sample is ready to be analyzed.

7.3 EQUIPMENT DECONTAMINATION

To prevent cross contamination of samples due to contaminated sampling equipment, all sampling equipment in contact with the sampling area will be decontaminated using a thorough wash with a deionized water/Alconox® mixture. This procedure is further outlined in Matrix's sample collection SOP.

7.4 SAMPLE DISPOSAL

Sample disposal, when necessary, will be done at the end of the work day while the Matrix unit is still occupying the collection site. If this is not possible, all disposal will be done properly at a later date. Sample disposal to meet with state regulatory needs will be done at a later date when proper disposal can be achieved. The samples will be collected throughout the work day in proper containers.

7.5 HOLE ABANDONMENT

This procedure is further discussed in Matrix's sample collection SOP.

8.0 LABORATORY OPERATIONS

8.1 SAMPLE CONTROL AND RECORDS

A representative sample will be collected and given to the laboratory for the analysis to begin, as required by the field consultant. Whenever possible, samples will be analyzed immediately and added to the sample control form by the field chemist (see 6.2 A 4). If the chemist is unable to immediately analyze a sample, it will be properly labeled and stored in refrigerator (or on ice) until it can be analyzed (generally, no longer than 24 hours); soils will be methanol extracted ASAP for analysis or storage. All samples will be disposed of as per state requirements. Any samples received in questionable condition will be noted in the comments section of the sample control Form # LAB I-1.

8.1 SAMPLE CONTROL AND RECORDS (continued)

Each mobile lab will contain a maintenance log book for recording all trouble-shooting, instrument adjustments and daily maintenance. Each lab will also contain a run log book for the purpose of tracking every run completed on the instrument for all activities (including projects and calibrations).

8.2 DATA PROCESSING

Data results are directly acquired from a computer. The analyst shall verify that all parameters (sample name, response factors, dilution amounts, multipliers, etc.) are accurate. The analyst shall sign and date the output. These results are then transferred to a field results table.

8.3 PROJECT BACKUP AND ARCHIVING

Project data is backed up onto CD-R every two to four weeks. Both, the report hard copies as well as the backups are stored in archive. Hard copies will be retained for a period of five (5) years before getting destroyed while the tape backups will be retained for ten (10) years.

9.0 LABORATORY QUALITY CONTROL ASSESSMENT

9.1 QUALITY CONTROL EVALUATION

9.1.1 Initial calibration - shall be performed prior to scheduled work to establish a standard curve. The curve is to include a minimum of five points covering the working calibration range of the instrument. The correlation coefficient for all compounds should be 0.995 or greater and the curve shall utilize a quadratic fit. When initial calibration is complete, the calibration shall be tested against a second source standard to independently confirm identification and quantification of all compounds of interest.

9.1.2 Continuing Calibration Evaluation - A lower-level and an upper-level standard should be analyzed daily and after every set of ten samples to evaluate the instrument's performance. Recoveries should be at least $\pm$ 30% of the initial curve or corrective action should be taken. If a continuing calibration standard fails twice, corrective action must be taken such as recalibration, instrument or standard evaluation, etc.

9.1.3 Method Blank - Blanks shall be run at the beginning of each analysis day. A blank is also run if a highly contaminated sample is analyzed and sample carryover is likely to occur. The method blank shall be prepared following the procedure step-by-step, including the addition of all solvents and reagents in quantities specific to the method. If this method blank interferes with the quantification of target analytes, steps shall be taken to reduce or eliminate the interferences. If this cannot be done, the magnitude of the interference shall be considered when quantifying the concentration of the target analyte.

9.1.4 Matrix Spikes - Mid-level spike standards shall be run for at least every ten samples. The observed recovery of the matrix spike versus the theoretical spike recovery shall be used to calculate the percent recovery and the accuracy of the calibration curve. If the accuracy value exceeds the control limits, the reason for nonconformance will be determined and documented. Corrective action will also take place and may include re-analysis.

9.1.5 Surrogate Standard - A surrogate is an organic compound which is similar to the target analyte(s) in chemical composition and behavior in the analytical process, but which is not normally found in environmental samples. A surrogate will be added to every sample, standard, and blank when possible (exceptions include the analysis of soil gas and standards that contain compounds which coelute with BFB). This standard is used to check sample matrix affects, retention time shifting, calibration curve accuracy, precision accuracy. Percent recoveries attained should be within +/- 30%.

9.2 REPORT LIMITS

Reporting limits (RLs) for the analytes of interest are developed from the generation of method detection limits (MDL) which is the lowest level the analytical system can effectively achieve on a repetitive basis. RLs are set 2-5 times the method detection limit for each compound of interest. The generation of a MDL is done by repetitively analyzing chemical standards at the expected low reporting levels and statistically developing the MDL. RLs are higher than the MDLs.

9.3 PRECISION AND ACCURACY DATA

9.3.1 Frequency and Acceptance Criteria

9.3.1.1 Matrix spikes and spike duplicate samples will be prepared and run with each project or with each twenty samples (where applicable). When spiking solutions are not practical or applicable, sample duplicates will be prepared and analyzed daily or after ten samples.

9.3.1.2 Relative percent difference (RPD) requirements for sample or spike duplicates are ≤ 30 %.

9.3.1.3 When precision and accuracy data are not acceptable, the sample batch should be re-analyzed (when possible) or the data is to be flagged. Corrective action should be taken to correct the problem.

9.4 PERFORMANCE EVALUATION SAMPLES

Matrix is engaged in a continuous informal audit system where we receive performance evaluation (PE) samples from an outside company. These PE samples contain numerous unknown volatile organic compounds at unknown levels. Matrix analyses these samples in-house and the results are then submitted to the company. Later, we receive the results comparing our performance to the actual concentration of the compounds and also compared to the results submitted from all the laboratories participating in the program. The results of these studies are recorded by the Quality Assurance Officer.

9.5 DATA HANDLING

A. Calculation of the Mean (x).

$$X = \frac{\text{(summation of all entries)}}{\text{(number of entries)}}$$

B. Calculation of the Standard Deviation (SD).

$$SD = \frac{[\text{sum}(X\text{-}x)\text{^}2]}{[\text{\# of entries - 1}]\text{^}1/2}$$

C. Calculation of the Relative Percent Difference (RPD).

$$RPD = \frac{\text{ABS(value 1-value 2)}}{\text{Average of two values}} \times 100$$

D. Calculation of Percent Recovery (%R).

$$\%R = \frac{\text{sample observed value}}{\text{sample known value}} \times 100$$

10.0 RECORDS

Matrix keeps two types of records for all projects performed and completed. These two types are electronic and physical. Both types are complete in every aspect and secured so that only limited access is possible.

10.1 ELECTRONIC RECORDS

Matrix has electronic copies of all chromatograms, lab reports, tables, final reports and proposals for every job performed. These records are stored electronically according to a Matrix assigned project number.

10.2 PHYSICAL RECORDS

Matrix keeps a file of all chromatograms, lab reports, tables, final reports, and proposals for every job performed. These records are stored according to a Matrix assigned project number.

10.3 RECORDS SECURITY

All records retained by Matrix are kept in limited access conditions in order to insure client confidentiality and potential disruption by employees. Any employee access is documented for future reference.

10.4 RECORD ARCHIVING

All of Matrix's physical records will be archived for a time period of five (5) years. All of Matrix's electronic records, which are stored on a computer tape backup system will be archived for a total of ten (10) years. When these time periods have expired Matrix will destroy the records to preserve the confidentiality of the client.

APPENDIX B

ACRONYMS OR ABBREVIATIONS WHICH MAY BE USED

Acronym	Definition
4-BFB	4-Bromofluorobenzene (Surrogate)
BTEX	Benzene, Toluene, Ethyl Benzene, Xylenes
ECD	Electron Capture Detector
FID	Flame Ionization Detector
GC	Gas Chromatograph
GRO	Gasoline Range Organics
ID	Identification
LCL	Lower Control Limits
LWL	Lower Warning Limits
MDL	Methods Detection Limits
mL	Milliliter
uL	Microliter
MS	Matrix Spike
MSD	Matrix Spike Duplicate
PID	Photoionization Detector
ppb	Parts Per Billion
ppm	Parts Per Million
PVOC	Petroleum Volatile Organic Compounds
QA	Quality Assurance
QC	Quality Control
RPD	Relative Percent Difference
RSD	Relative Standard Difference
SD	Standard Deviation
SOP	Standard Operating Procedure
SS	Surrogate Standard
UCL	Upper Control Limit
UWL	Upper Warning Limit
VOC	Volatile Organic Compound
XSD	Halogen Specific Detector

Standard Operating Procedure # LAB001

VOC, PVOC & TPH as GRO/FO
in Soil & Groundwater by Purge & Trap/GC/PID/XSD/FID

Matrix Environmental, LLC.
Revision 3: (01/14/03)
Method: VOC3D, EZ Chrom or HP ChemStation

1.0 SCOPE AND APPLICATION

1.1 This method is used to quantitatively determine the concentration of various aromatics and halogenated volatile organics in groundwater and soil and is derived from EPA Method SW-846 8021 and MDH method 465F following the minimal requirements set by the MPCA for mobile laboratories. This method is also used for quantitative determination of petroleum volatile organics (PVOC) and total petroleum hydrocarbons (TPH) as gasoline range organics (GRO) in groundwater and soil as derived from the Wisconsin DNR modified GRO method. Matrix Environmental also uses this method for determination of purgeable TPH as F.O. (fuel oil #2) by EPA method 8015 in groundwater and soil. All compounds are analyzed via purge and trap and gas chromatography.

2.0 SUMMARY OF METHOD

2.1 Inert nitrogen is passed through 5.0 mL (or 10-20 mL for increased sensitivity) of a groundwater sample in a sparge vessel (derived from method 624) where the volatile compounds are transferred into the gaseous phase and adsorbed onto an organic trap. For soils, up to 250 uL (20x) of a 1:1 extract of soil (wet-weight) to methanol is injected into the sparge vessel (derived from method 5035 if held and not analyzed immediately). The trap is then rapidly heated, introducing the trapped components onto a gas chromatograph (GC), where the components are separated by temperature-programmed GC and detected by a photoionization detector (PID) and then split between a halogen specific detector (XSD) and a flame ionization detector (FID) in series. Reporting limits (RLs) are listed in Table 1 of appendix 1.

3.0 INTERFERENCES

3.1 A method blank will be analyzed each day to monitor the analytical system for possible contamination and confirm that the method is functional.

3.2 Detector saturation may require the subsequent analysis of a blank to assure there is no carryover left in the system.

3.3 A sample containing high levels of a complex product (e.g. fuel oil) may interfere with the identification and quantification of individual analytes. RLs will also be increased (by multiplying the RL with the dilution factor) if the sample requires dilution.

4.0 EQUIPMENT

4.1 Purge and Trap: OI Analytical 4560 sample concentrator or Tekmar LCS 2000/ALS 2016.

4.2 Gas chromatograph: Hewlett Packard 5890 Series I or II or equivalent.

4.3 Trap: OI Analytical # 10 or equivalent.

4.4 Detectors: HNU PID model PI-52-02A, Hewlett Packard FID and OI Analytical XSD model 5300 or equivalent models.

4.5 Column: Capillary column J&W DB-624, 75 meters, 3.0 um film thickness, 0.53 mm ID or equivalent.

4.6 Syringes: 5 mL, 1000 uL, 500 uL, 250 uL, 100 uL, 25 uL and 10 uL Hamilton gas-tight syringes or equivalent.

4.7 Gases: Ultra-high purity nitrogen, grade 5.0 hydrogen and dry compressed air.

5.0 REAGENTS AND STANDARD PREPARATION

5.1 Standards:

5.1.1 Stock standards: (Designated as ST#- and stored with minimal headspace in a vial with a red cap) Stock standards containing the analytes of interest (see table 1), are purchased from Ultra Scientific and Absolute Standards Corporation or equivalent as certified methanol solutions and stored at -10° C to -20° C in office freezer. Standards will be stored in mobile lab refrigerator (or cooler if lab is not equiped with refrigerator) with temperature monitoring at 2°-6° C. Standards are NIST traceable and verified with a second source standard upon receipt as to correct composition and concentration. Unopened standards should be replaced within the mfg. expiration date or sooner. High concentration stock standards will be kept for a maximum of 1 year after opening.

5.1.2 Surrogate standards: Prepared from the BFB stock standard by diluting in purge and trap grade methanol to a working concentration of 20 ug/mL (20 ppm). A 10 uL injection of this into 5.0 mL water results in a concentration of 40 ug/L (ppb). After dilution, BFB will be considered a working standard and designated as WS#- and stored in a vial with a blue cap. Replace every 4 weeks or sooner.

5.1.3 Secondary dilution standards: (Working standards designated as WS#-, blue cap or Calibration standards designated as CS#-, green cap) Prepared from the various stock standards by dilution to 20 ug/mL (ppm) in purge and trap grade methanol. Replace every 4 weeks or sooner.

5.1.4 Standard description, solvent, preparation dates, lot numbers, opening dates, verification of composition and concentration check-off, and manufacturers concentrations shall be recorded in a standard logbook in order to maintain traceability.

5.2 Reagent water: Deionized and carbon-filtered water.

5.3 Methanol: Purge and trap grade.

6.0 SAMPLE COLLECTION, PRESERVATION AND HANDLING

6.1 See Matrix S.O.P "Groundwater Sample Collection" and QA Manual section 8.0 Laboratory Operations.

7.0 PROCEDURE

7.1 Purge and trap conditions:

Purge pressure	20 psi
Purge time	8 minutes
Standby	36° C
Dry Purge	1 minutes
Desorb preheat	245° C
Desorb temp.	250° C
Desorb time	1 minute
Bake temp.	260° C
Bake time	8-10 minutes
Bake gas bypass	Off
LSC 2000 valve	150° C (if autosampler used)
LSC 2000 transfer line	150° C
LSC 2000 mount	150° C
ALS 2016 valve	150° C
ALS 2016 transfer line	150° C

7.2 Gas chromatograph conditions:

Column head pressure 14 psi @ 45° C

Injector temp.	150° C
PID temp.	250° C
PID input attn.	100
PID recorder attn.	4
XSD temp.	1100° C
Oven program:	Initial temp 45° C, initial time 3 min. Rate 8° C/min. to 120° C, final time 0. Rate A 20° C/min. to 230° C, final time 2 min.

7.3 Gas flows:

Carrier flow	Nitrogen @ 6 mL/min.
Make-up flow	Nitrogen @ 25 mL/min.
Purge flow	Nitrogen @ 40 mL/min.
XSD exhaust flow	air @ 20-40 mL/min.
FID exhaust flow	air @ 90 mL/min, hydrogen @ 35mL/min.

7.4 Calibration:

7.4.1 A calibration curve for each analyte is established using the method of external calibration using peak area versus ug/L concentration. At least five points will be used to calibrate each analyte while maintaining a correlation coefficient of at least 0.99.

7.4.2 Liquid standards are used to calibrate for the analytes of interest. All calibration standards including BFB are prepared using a 20 ug/mL methanol solution standard as follows:

- 2.5 uL of 1:10 dilution of 20 ug/mL (2 ug/mL) = 1.0 ug/L
- 10.0 uL of 1:10 dilution of 20 ug/mL (2 ug/mL) = 4.0 ug/L
- 5.0 uL of 20 ug/mL = 20 ug/L
- 10.0 uL of 20 ug/mL = 40 ug/L
- 25.0 uL of 20 ug/mL = 100 ug/L

7.4.3 The calibration curve will be verified daily with a second source calibration check standard containing the analytes of interest. The calculated concentration of each analyte should give a <30% difference from the true value. The instrument will be calibrated on a project specific basis, and recalibrated when degradation of the calibration is apparent in the standard checks.

7.5 Sample Analysis:

7.5.1 1,4-Bromofluorobenzene (BFB) is added to each blank, standard (except standards that contain coeluting compounds) and sample to monitor total system performance and retention time accuracy, and to identify possible matrix effects. 5 mls (+/-0.1 mL) of the water sample is measured in a 5 mL syringe to which is added 10 uL of a solution containing 20 ug/mL BFB, resulting in a final concentration of 40 ug/L. [For soil samples, Matrix recomends using the Encore coring device or an equivalent mechanism. A maximum of 250 uL (20x) of the 1:1 wet soil/ methanol extract is injected into the 5 mL sample syringe].The water or soil extract sample is then placed into the purge and trap concentrator and purged at a sample temperature of 50 degrees celcius for 8 minutes. Soils may also be analyzed at a 1x or 5g amount when needed and allowed.

7.5.2 Dilution: A sample may need to be diluted if high concentrations of one or more compounds are present. Dilutions can be made with a gas-tight syringe into the 5mL sample injection syringe, always maintaining a 5.0 mL total purge volume.

7.5.3 Identification: The retention times of unknown peaks are compared with the retention times of known peaks in the check standard. The unknown peak retention time should be +/- 0.1 minutes of the known peaks. The judgement of the analyst will be used to determine the extent of interferences from the sample matrix and whether this affects the quantitation of individual analytes (e.g. weathered gasoline may contain compounds which interfere with the quantitation and/or identification of individual VOCs).

8.0 QUALITY CONTROL

8.1 Summary of QC related activities:

Surrogate standard	every sample run
Method blank	at least one per day
Calibration check standard	one per day
Sample duplicate	one per day
Matrix spike	one every ten samples
Relative percent difference	calculated from the matrix spike/duplicate
Method detection limit	annually

8.1.1 A surrogate standard (4-Bromoflourobenzene) is added to every blank, standard, and sample run through the instrument at a concentration of 40 ug/L. The recovery of BFB should be within 30% of the known concentration added to the sample. If the resulting concentration falls outside this range then the sample needs to be rerun or a reason for the discrepancy needs to be addressed by the analyst (eg. weathered gasoline may produce coeluding peaks that elevate the surrogate response).

8.1.2 At least one method blank will be analyzed per day. A method blank is prepared by purging 5 mL of DI water containing 40 ug/L BFB. The calculated concentrations of any analyte present should be less than it's RL. If the system does not appear to be clean, and there are continuous background hits, they will be reported as such. Blanks will also be run if detector saturation occurs to assure that no contamination is present in the system. GC and purge trap bake times may be increased to clean up the system.

8.1.3 Calibration check standards containing the compounds of interest (see table 1) will be analyzed during the project at or near 10 ug/L and 80 ug/L (ppb) to bracket the working range of the calibration. The standards will be from a second source different from the calibration standards. The percent recovery of each compound should be within 30% of the true value. If the percent recovery is greater than 30%, the instrumentation will be evaluated for problems. If any problems are found they will be reported in the instrument maintenance logbook, after which another check standard will be run. If this is also out of calibration a new curve will be generated as soon as possible, and all out of calibration compounds will be flagged as estimated values on project samples. The client will be consulted prior to the institution of flags.

8.1.4 One sample duplicate (or 1 per 20) will be run per day and the results should have a relative percent difference within 20% (see 11.4). If not within 20%, the sample should be run a third time and reported and a reason for the discrepancy investigated (eg. poor sample collection technique).

8.1.5 Matrix spike and matrix spike duplicate (MS/MSD) samples will be run approximately every ten samples or as time permits. The standards used to spike our samples will be composed of all or most of the analytes of interest for the site. Matrix spikes are actual project samples spiked with working standards. If blank water is used instead of actual project samples the results must be labeled as blank spikes. Spike and spike duplicates should be run at or near 10 ug/L and 80 ug/L during the course the day to cover the calibration range. Percent recoveries are calculated (see 11.3) from all MS/MSD analyses. Percent recoveries should fall within 30% of the known value. If the recoveries are not within 30% the instrumentation will be checked for problems. If any are found, they will be reported in an instrument maintenance logbook, after which another spike standard will be run. Any samples run between the last spike within range and an out of range spike should be rerun after another spike within range has been run unless the reason for the spike being out of range can be explained (such as interfering compounds in the sample matrix).

8.1.6 Relative percent difference (RPD): RPDs are calculated (see 11.4) from MS/MSD recovery data. The RPD of each compound should be less than 20%. If they are not a subsequent MS needs to be run until the RPD is less than 20% or a reason for the discrepancy needs to be given by the analyst.

8.1.7 Method detection limit (MDL), (see 11.5) studies will be performed at least yearly in accordance to CFR Title 40, Pt. 136, Appendix A. Reporting limits (RLs) are derived from the MDL data and are defined as 2-5x the MDL.

8.1.8 The chemist will record within the laboratories log books all information pertinent to calibrations, trouble-shooting and project related data such as runs. See QA Manual section 8.1.B.

9.0 <u>DATA REDUCTION</u>

9.1 All data will be computer generated based on known retention times and current calibration producing a linear or quadratic equation for each analyte of interest. Unknown analytes in a sample will be qualified by matching retention times and quantified using a regression from the calibration curve.

10.0 <u>MOBILE LABORATORY SPECIFICATIONS</u>

10.1 The laboratory will be placed near the sampling area in such a way as to eliminate or reduce the possibility of contamination of the lab.

10.2 The exact positioning will be determined upon arrival. The laboratory will be powered either by its built-in generator or by 110 volt utility hookups with extension cords and contain all necessary equipment and reagents to perform the on-site analytical functions required for the project.

10.3 The laboratory will provide temperature monitored, separate storage spaces for standards and samples so as to reduce contamination concerns.

11.0 <u>EQUATIONS</u>

11.1 Response Factor

$$RF = \frac{\text{area measured for compound}}{\text{concentration of compound}}$$

11.2 Percent Difference

$$PD = \frac{\text{RF of cal check std– RF of initial cal std.}}{\text{RF of initial cal std.}} \times 100$$

11.3 Percent Recovery

$$\%R = \frac{\text{observed sample concentration}}{\text{expected concentration}} \times 100$$

11.4 Relative Percent Difference

$$RPD = \frac{/X_1\text{-}X_2/}{(X_1+X_2)/2} \text{ (absolute value)} \times 100$$

Where X_1 = % recovery

X_2 = % recovery of duplicate

11.5 $MDL = t_{(n-1,\, a=0.99)}\,(s)$

Where $s = (S^2)^{1/2}$

$$X = 1/n \ \left[\sum_{i=1}^{n} (x_i\text{-}x)^2\right]$$

$$S^2 = 1/(n\text{-}1) \left[\sum_{i=1}^{n} (x_i\text{-}x)^2\right]$$

t = students t value

11.6 RL (reporting limit) = 2-5 x MDL

12.0 TABLES

MATRIX Environmental, LLC
Mobile Lab Reporting Limits
Modified EPA Method 8021/Modified MDH 465F

Parameter	*MDL*	ug/l Water *RL*	mg/kg Soil - 5gm *RL*	mg/kg Soil - 5035 *RL*	mg/m3 Soil Gas *RL*	Analytical Method
Acetone	3.548	10.0	0.050	1.00	500	SW 846 8021
Benzene	0.377	1.0	0.005	0.10	50	SW 846 8021
Bromodichloromethane	1.670	4.0	0.020	0.40	200	SW 846 8021
1,2-Dibromoethane	0.804	2.0	0.010	0.20	100	SW 846 8021
Bromoform	0.718	2.0	0.010	0.20	100	SW 846 8021
Carbon Tetrachloride	1.678	5.0	0.025	0.50	250	SW 846 8021
Chlorobenzene	0.528	2.0	0.010	0.20	100	SW 846 8021
Chloroethane	0.750	2.0	0.010	0.20	100	SW 846 8021
Chloroform	2.618	6.0	0.030	0.60	300	SW 846 8021
Dibromochloromethane	0.971	2.0	0.010	0.20	100	SW 846 8021
1,2-Dichlorobenzene	0.535	2.0	0.010	0.20	100	SW 846 8021
1,3-Dichlorobenzene	0.409	1.0	0.005	0.10	50	SW 846 8021
1,4-Dichlorobenzene	0.429	1.0	0.005	0.10	50	SW 846 8021
1,1-Dichloroethane	0.435	1.0	0.005	0.10	50	SW 846 8021
1,2-Dichloroethane	0.785	2.0	0.010	0.20	100	SW 846 8021
1,1-Dichloroethene	0.473	1.0	0.005	0.10	50	SW 846 8021
Cis-1,2-Dichloroethene	0.451	1.0	0.005	0.10	50	SW 846 8021
Trans-1,2-Dichloroethene	0.340	1.0	0.005	0.10	50	SW 846 8021
1,2-Dichloropropane	1.960	4.0	0.020	0.40	200	SW 846 8021
Cis-1,3-Dichloropropene	1.558	4.0	0.020	0.40	200	SW 846 8021
Trans-1,3-Dichloropropene	0.340	1.0	0.005	0.10	50	SW 846 8021
Ethyl benzene	0.522	2.0	0.010	0.20	100	SW 846 8021
Methyl ethyl ketone	0.756	2.0	0.010	0.20	100	SW 846 8021
Methylene Chloride	1.235	3.0	0.015	0.30	150	SW 846 8021
Methyl tert Butyl Ether	1.549	5.0	0.025	0.50	250	SW 846 8021
MIBK	0.954	2.0	0.010	0.20	100	SW 846 8021
Napthalene	0.628	2.0	0.010	0.20	100	SW 846 8021
Styrene	0.749	2.0	0.010	0.20	100	SW 846 8021
1,1,1,2-Tetrachloroethane	0.549	2.0	0.010	0.20	100	SW 846 8021
1,1,2,2-Tetrachloroethane	0.905	2.0	0.010	0.20	100	SW 846 8021
Tetrachloroethene	0.473	1.0	0.005	0.10	50	SW 846 8021
Tetrahydrofuran	3.208	10.0	0.050	1.00	500	SW 846 8021
Toluene	0.453	1.0	0.005	0.10	50	SW 846 8021
1,1,1-Trichloroethane	0.423	1.0	0.005	0.10	50	SW 846 8021
1,1,2-Trichloroethane	0.965	2.0	0.010	0.20	100	SW 846 8021
1,2,4-Trimethylbenzene	1.072	3.0	0.015	0.30	150	SW 846 8021
1,3,5-Trimethylbenzene	0.942	2.0	0.010	0.20	100	SW 846 8021
Trichloroethene	0.288	1.0	0.005	0.10	50	SW 846 8021
Vinyl Chloride	1.516	4.0	0.020	0.40	200	SW 846 8021
M&P-Xylene	1.042	3.0	0.015	0.30	150	SW 846 8021
O-Xylene	0.521	2.0	0.010	0.20	100	SW 846 8021
TPH as GRO	10	50	0.25	5		WIDNR Mod. GRO
TPH as Fuel Oil	50	250	1.25	25		SW 846 8015

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for Lab ID # 51MN

APPENDIX D

BT^2 Standard Field Procedures

APPENDIX D
BT^2 STANDARD FIELD PROCEDURES

TABLE OF CONTENTS

APPENDIX D
BT^2 STANDARD PROCEDURES

TABLE OF CONTENTS (CONTINUED)

APPENDIX D
BT^2 STANDARD PROCEDURES

TABLE OF CONTENTS (CONTINUED)

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1.0 LABELING OF MONITORING WELLS, BORINGS, AND OTHER SAMPLING AND REFERENCE POINTS

1.1 Scope

This SOP describes standard procedures for labeling monitoring wells, soil borings, and other common sampling and reference points.

1.2 Background

The objectives of standardizing the designation of sampling and reference points are:

- To provide consistency in documentation of field sampling and reference points.
- To communicate information about the type of sampling point by using standard designations that represent the general types of sampling points.
- To avoid confusion resulting from non-unique, vague, or misleading labeling of sampling points.

The purpose of the standard procedure is to provide a labeling scheme for common sampling and reference points and serve as the basis for devising labeling schemes needed for complex or unusual sites, or for sites on which sampling and reference points have previously been designated by site owners or other consultants.

1.3 Procedures and Documentation

1.3.1 General Guidelines

When developing a labeling scheme the following general guidelines apply:

1.3.1.1 Numbering

A number is to be used to identify a location at a site. Generally, a location has a radius of about 10 feet. The following is an example.

> A monitoring well, installed within 10 feet of a previously installed boring, B**2**, is designated MW**2**. A piezometer, installed within 10 feet of the monitoring well, is designated MW**2P**. A test pit excavated at the location is designated TP**2**.

Numbering at a site should begin at **1** unless sampling and reference points have already been established at the site. To avoid nonspecific numbering at a site when you are unsure of what numbers have been already used, or if sampling or reference points designated for purposes other than yours exist at the site, start with number 100 or 200. The following are examples.

> At an existing landfill, monitoring wells were designated MW1 through MW135, with some ambiguity if wells with numbers greater than 135 had previously existed at the site. The new series of wells installed for the landfill expansion were designated MW201 through MW212.
>
> At an industrial site, an ongoing geotechnical investigation is using a labeling scheme of B1 through B55. The environmental investigation used a designation system starting with B201 to avoid possible overlap with the geotechnical borings that might eventually exceed 100 in number.
>
> At a petroleum release site, a monitoring well, MW7, was located in the road right-of-way and was part of the monitoring network for an adjacent petroleum release investigation. Access to MW7 could not be obtained, so a well was installed within 10 feet of MW7 and was designated MW7BT (BT for BT^2).

1.3.1.2 Replacements

If a sampling or reference point is removed and then replaced within 10 feet of the original point, it is designated with an **R**. The following is an example.

> MW2**R** is a replacement well installed within 10 feet of the original MW2, which was removed.

1.3.1.3 Unsuccessful Installations

If the installation at a sampling point is unsuccessful, the unsuccessful attempts at the location should be designated with an **X**. The following is an example.

> A boring could not be advanced to its target depth because of refusal on boulders. Two attempts were made within 10 feet of the original location before the boring was advanced to its target depth. The unsuccessful borings were designated B14**X**, and B14**XX**. The successful boring was designated B14.

1.3.2 General Designations

The following designations should be used unless site activities require a unique labeling scheme.

1.3.2.1 Borings

B	A boring not converted to a permanent sampling point. Example **B2**.
GB	A boring installed using direct-push technology and not converted to a permanent sampling point. Example **GB2**.
HA	A hand-auger boring not converted to a permanent sampling point. Example **HA2**.

1.3.2.2 Wells

MW	A monitoring well used to measure water levels and collect groundwater samples for field or laboratory analysis. Constructed such that the water table intersects the screen. Example **MW2**.
MW P	A monitoring well used to measure water levels and collect groundwater samples for field or laboratory analysis. Constructed such that the screen is below the water table. Example **MW2P**.
MW PP	A monitoring well used to measure water levels and collect groundwater samples for field or laboratory analysis. Constructed such that the screen is below the water table and is deeper than the next deepest well. Example **MW2PP**.
MW Q	A monitoring well used to measure water levels and collect groundwater samples for field or laboratory analysis. Constructed in a perched aquifer. Example **MW2Q**.
MW T	A temporary well. Examples **MW2T**, **MW2PT**.
PZ	Small diameter well used only for measuring water levels. Example **PZ4**.
EXT	Groundwater extraction well. Example **EXT2**.
SV	Soil vapor extraction well. Example **SV7**.
TW	Groundwater pump test well. Example **TW2**.
PW	Private drinking water supply well. Example **PW13**.

1.3.2.3 Other Monitoring Well Designations

Sites with extensive monitoring systems may require monitoring well designations that reflect the site stratigraphy. (Avoid the use of A, B, C designations as these convey little or no information.) Select letters designations that provide stratigraphic information. The following is an example for nested wells at a site with four stratigraphic units.

MW2SG	Monitoring well installed in the sand and gravel aquifer. The screen intersects the water table.
MW2D	Monitoring well installed in the dolomite underlying the sand and gravel. The screen is below the water table.
MW2SS	Monitoring well installed in the sandstone underlying the dolomite.
MW2PC	Monitoring well installed in the PreCambrian rock underlying the sandstone.

1.3.2.4 Other Sampling Points

TP	Test pit excavated with a backhoe or by hand. Example **TP5**.
SW	Surface water sampling point. Example **SW5**.

1.3.2.5 Reference Points

SG	Staff gauge, surface water level measuring point. Example **SG5**.
M	Survey control monument. Example **M5**.
MH	Manhole. Example **MH7**.
UTR	Underground storage tank riser. Example **UTR5**.

1.3.3 Creation of Numbering System

Each numbering system shall be prepared by the project technical coordinator planning the sampling or reference point setup.

1.3.4 Numbering System Review and Approval

Before beginning field or office work (workplan preparation, bid specification preparation, etc.) on the project, the numbering system should be approved by the Project Manager.

1.3.5 Revision of Numbering System or Individual Sampling or Reference Point Designation

A revision to the numbering system or to an individual sampling or reference point designation must be approved by the Technical Coordinator and the Project Manager. After approval is obtained, the change to the numbering system should be documented by a memo to the project team and file. Changes made to an individual sampling or reference point designation must be documented on all existing original forms including field notes, field forms such as boring logs, monitoring well diagrams, etc., and finalized report-ready versions of these and similar forms. The changes are to be indicated by drawing a single line through the original designation, then writing the revised designation beneath it, initialing and dating the revision.

1.4 Limitations on Standard Procedure Application

A project may require a labeling scheme for sampling and reference points that serves special needs and is not compatible with the general scheme for common sampling and reference points described in the standard procedure.

2.0 SOIL BORING – DRILLED

Soil borings are drilled to create boreholes in which wells or other subsurface monitoring and sampling points can be installed. Soil borings can also be used to collect discrete soil samples for logging, field screening, and analytical sample collection. The drilling equipment is operated by a subcontractor. The BT^2 geologist is responsible for selecting sampling intervals, logging and screening samples after they are collected, placing samples in appropriate containers for laboratory analysis, and documenting sampling procedures.

- Collect split-spoon samples at 2.5-foot intervals using standard split-spoon sampling techniques. Split-spoons will be driven 18 inches to 24 inches, with the longer interval to be used if sample recovery is poor.

- Sample borings continuously if, in the judgment of the field geologist, soil particle size, stratigraphy (layering), or degree of sorting are so variable that the entire soil column needs to be sampled.

- Examine each split-spoon sample for soil type (Unified Soil Classification System (USCS)), moisture, grain size distribution, consolidation (blow counts), color, stratigraphic features, and discoloration or odors.

- Record field observations and measurements on field record forms, soil boring logs, and in the field logbook. Record other information concerning field activities and conditions in the field logbook.

The procedures for collecting headspace readings from soil samples are provided in **Section 4.0**. The procedures for collecting analytical soil samples are provided in **Section 5.0**. The procedures for managing soil cuttings generated by drilling are provided in **Section 12.0**. The procedures for monitoring air conditions in the breathing zone during drilling are provided in **Section 13.0**.

Soil borings can be drilled using a variety of drilling techniques including, but not limited to, hollow stem auger drilling, air rotary drilling, and mud rotary drilling. The type of drilling selected will be project-specific and will depend on site geology, project sampling needs, and the intended end-use of the soil boring. The required drilling technique will be specified in the project workplan.

3.0 SOIL BORING – DIRECT PUSH TECHNOLOGY

The direct push technology Geoprobe™ (geoprobe) system can be used to collect discrete soil, groundwater, and soil vapor samples from the subsurface. Soft, shallow soil can be drilled and sampled quickly. During drilling, the sampler remains sealed as it is pushed or driven to the desired sampling depth. A piston stop-pin is removed after the sampler has reached the sampling depth. This allows the piston to retract so that soil enters the sampling tube as it is driven through the soil sampling interval. The soil sample interval is 4 to 5 feet long, and the soil sample cores are approximately 1 inch to 1.5 inches in diameter.

The geoprobe can be used to collect discrete soil samples for logging, field screening, and analytical sample collection. The soil sampling procedures to be used by BT^2 personnel are similar to those used in soil sampling using split-spoons in augered borings. The geoprobe sampler is operated by a subcontractor. The BT^2 geologist is responsible for selecting sampling intervals, logging and screening samples after they are collected, placing samples in appropriate containers for laboratory analysis, and documenting sampling procedures.

- Collect geoprobe soil samples continuously unless a sampling interval is specified in the project workplan.

- Examine each soil sample for soil type (USCS), moisture, grain size distribution, color, stratigraphic features, and discoloration or odors.

The procedures for collecting headspace readings from soil samples are provided in **Section 4.0**. The procedures for collecting analytical soil samples are provided in **Section 5.0**. The procedures for managing soil cuttings generated by drilling are provided in **Section 12.0**. The procedures for monitoring air conditions in the breathing zone during drilling are provided in **Section 13.0**.

4.0 HEADSPACE ANALYSIS

4.1 Scope

This Standard Operating Procedure (SOP) outlines the procedure through which soil headspace is measured in the field using a photo-ionization detector (PID) or a flame-ionization detector (FID).

4.2 Background

Field headspace measurements are used in a number of ways. Although the use of the screening varies, the manner in which soil is screened does not. This SOP is intended as a guide to field headspace screening.

4.3 Procedures

The following procedures are specific to the Thermo Environmental Model 580B PID and the Sensidyne FID. If using other equipment, follow the manufacturer's instructions for calibration and use.

- Unplug PID or FID in office, pack up in case, and proceed to field site
    - o Calibrate PID
        - Insert RUN key
        - Turn PID on

- Press "mode/store"
- Press "-/CSR"
- Press "-/CSR"
- Press "-/CSR"
- Press "-/CSR" display will say "reset to calibrate"
- Press "reset"
- Press "-\CSR" display will read "zero gas reset when ready"
- Press "reset" display will read "580 zeroing" then "span=0100"
- Press "+" display will read "span gas when ready"
- Attach 100 ppm gas to PID
- Press "reset" display will read "calibrating" then "reset to calibrate"
- DO NOT PRESS RESET
- Unplug the RUN key
- Plug the RUN key back in
- Turn PID on
- Record calibrated reading and background range

- o Turn on FID
  - Turn the on/off knob to R1
  - Open valve on gas tank
  - Adjust flow - ball should be at or below center line
  - Press "ignite" button
  - Unit is lit when beeping stops
  - Turn unit off if there is a long wait between samples - battery will die

- Collect and Run Sample
  - o Fill sealable plastic bag approximately ¼ full of soil
  - o Break up the soil to the extent possible
  - o Allow soil to warm out of direct sunlight
  - o Open corner of baggie and insert tip of PID or FID
  - o Hold tip of PID or FID approximately ¾ inch from soil in baggie
  - o Wait 10 to 15 seconds for PID or FID to make reading
  - o Record highest reading on meter
- Repeat for each sample to run
- Return PID or FID to box until back in the office
- Plug the PID or FID into the appropriate charger

5.0 SOIL SAMPLE COLLECTION

5.1 General

Follow these general methods for all soil sampling (semi-volatiles, metals, pesticides/herbicides, polychlorinated biphenyls, etc.) except sampling for volatiles organic compounds (volatiles) with methanol preservation. Procedures for sampling volatiles with methanol preservation are detailed in **Section 5.2**.

- Place soil samples into sample containers appropriate for the analytical method.
- Place all laboratory sample jars immediately on ice in a cooler and deliver by courier to a laboratory to analyze the target analyte(s).
- Complete sample documentation, labeling, and shipping as described in **Sections 9.0** and **10.0**.

5.2 Volatiles

5.2.1 Scope

Soils are analyzed by methanol extraction in the vial, followed by purge and trap analysis. Soil concentrations must be reported on a dry weight basis. This method is based on extracting the soil contaminants with methanol. Soil or waste samples are dispersed in methanol to dissolve the volatile organic constituents. A portion of the methanol solution is then analyzed by purge and trap Gas Chromatography (GC) or Gas Chromatography/Mass Spectrometer (GC/MS).

Soil samples are collected in wide-mouth volatile organic compound (VOC) vials and preserved with methanol. Minimum handling is required to reduce loss of contaminants. This method is based in part on: (1) ASTM D4547-91; (2) USEPA SW-846: Methods 5030, 5035, 8000, 8015, and 8260; (3) a single laboratory method evaluation study conducted by the American Petroleum Institute; and (4) work by the EPA Total Petroleum Hydrocarbons Committee.

5.2.2 Equipment

The following equipment will be utilized by field personnel for methanol soil sample collection:

- Laboratory-prepared methanol preservation vials
- Field balance

- Stainless steel spatulas
- Nitrile gloves
- Plastic bags
- Field notebook or field data sheets

5.2.3 Procedure

NOTE: Methanol preservation is mandatory for the soil analysis method and must be noted on the chain-of-custody (COC). Sample collection time must be verifiable from the COC. Soil samples that arrive at the laboratory without methanol, which have not been stored properly, must be rejected. Results from soil samples not properly preserved in methanol will be rejected. Bulk sampling will not be permitted.

1. Prior to sampling activities, the field balance will be properly calibrated (procedures for field balance use is discussed in **Section 5.2.4**). Calibration will be recorded in the field notebook.

2. Put on nitrile gloves.

3. Place empty VOC sample container on field balance.

4. Tare the VOC sample container so the field balance reads zero.

5. Use a stainless steel spatula to collect the appropriate amount of soil required for the VOC sample. The weight of the soil should be between 25 and 35 grams. A separate portion of the soil will be collected for field screening (procedures for field screening are discussed in **Section 4.0**).

6. Immediately add 25 milliliters (mL) of methanol (provided by laboratory in pre-measured vials) to the soil in the VOC sample container.

7. Close the VOC sample container tightly, label sample, and place in a plastic bag. An additional 4 ounces of soil will be collected in a 4-ounce jar for shipment to the laboratory for measurement of percent solids. The 4-ounce jar will be placed in a separate plastic bag from the VOC sample container. In the event insufficient soil is available for percent solids, it will be noted in the field notebook and on the COC.

8. The sample weight will be recorded on a log form (an example form is included in **Section 5.2.5**). In addition, the vial/methanol weight will be recorded on the same form.

5.2.4 Field Balance

The following SOP outlines procedures for weighing methanol preserved, VOC samples in the field. The SOP includes equipment, calibration procedures, and equipment use procedures.

5.2.4.1 Equipment

The following equipment will be utilized by field personnel when using the field balance:

- Field balance
- 10-gram weight
- Two U.S. nickels

5.2.4.2 Calibration

The field balance will be calibrated prior to use in the field using the following procedures:

- The field balance will be turned to the on position (the field balance should read zero).

- The 10-gram weight will then be placed on the field balance. Note, if a 10-gram weight is not available, two U.S. nickels will be used in placed of the 10-gram weight. Each nickel weighs 5 grams for a total of 10 grams.

- If the field balance fails to read zero when turned to the on position or the balance reads +/- 10 grams when the 10-gram weight is placed on the balance, it will be replaced.

5.2.5 Methanol Preservation Field Log

The following table is an example of the methanol preservation field log to be completed during all sampling events where methanol preservation of soil samples is required. The following information will be included on the form, and will be sent to the laboratory with the COC.

Methanol Preservation Record

Project Number: ______________________

Project Name: ______________________

Project Location: ______________________

Date: ______________________

Field Sample I.D.	Sample Depth (feet)	Jar Weight (grams)	Jar w/MeOH Weight (grams)	Jar w/Soil & MeOH Weight (grams)	Soil Weight (grams)

6.0 GROUNDWATER SAMPLE COLLECTION

6.1 Well Construction and Development

- Construct and develop all groundwater monitoring wells in accordance with the project workplan and applicable state requirements such as:
  - o Iowa Administrative Code Chapter 110.11
  - o Wisconsin Administrative Code Chapter NR 141

- Develop wells by alternately surging and purging with a PVC bailer, and then purging the well with a PVC bailer or submersible pump. Surge and purge each well for 30 minutes, and then purge the well continuously until ten well volumes of water are removed or until the water is clear.

- If the well does not produce enough water for continuous purging, then bail down at least three times, allowing the well to recover in between.

6.2 Well Purging

- Proceed with groundwater sampling from the least contaminated well (based upon observations and field instrument readings during drilling or existing water quality data) to the most contaminated well.

- Note the condition of the monitoring well and verify the correct well to be sampled. Additional information may be required for documentation before, during, and after groundwater sampling.

- Measure the total depth of the groundwater monitoring well and the depth to the groundwater using the methods detailed in **Section 7.0** Water Level and Well Depth Measurements.

- Subtracting the depth to the groundwater from the total depth of the monitoring well will give you the height of the water column within the well.

- The well volume can be determined using the following conversion factors:
  - o Each foot of water in a 2-inch diameter well equals 0.16 gallons,
  - o Each foot of water in a 4-inch diameter well equals 0.66 gallons, and

- o Each foot of water in a 6-inch diameter well equals 1.5 gallons.
- o Multiply the well volume based on the height of the water column by three.

- Purge each well immediately prior to sampling using a PVC, Teflon, or stainless steel bailer attached to a dedicated sampling rope, a dedicated inertial lift pump, or a Grundfos submersible pump.

- Measure the volume of water removed from the well. Pump or bail water from the well until three to five well volumes have been removed.

6.3 Sample Collection, Preparation, Handling, and Preservation

6.3.1 General

- Calibrate field parameter measuring equipment, if required, as described in **Section 8.0**.

- After well purging has been completed, collect samples using a low flow sampling pump or a PVC bailer.

- Place groundwater samples in a sample container appropriate for the analytical method.

- Place all samples on ice for storage and shipping at approximate four degrees Fahrenheit.

6.3.2 Volatiles

- Samples for VOC analysis will be collected first.

- Gently fill a tilted 40-milliliter sample VOC preservation vial (preserved with HCl) with as little turbulence as possible.

- Place the Teflon-coated silicone septum carefully into place and screw cap on firmly.

- Invert the vial to check for air bubbles. If any are present, remove cap and refill to the top until a sample is obtained with no trapped air.

6.3.3 Semi-Volatiles

- Gently fill two 1,000-milliliter amber glass bottles.

6.3.4 Metals

- Gently fill one 1-liter HNO_3 preserved plastic bottle.

7.0 WATER LEVEL AND WELL DEPTH MEASUREMENTS

- Open all wells and allow water levels to equilibrate before measuring depths to water. Measure water levels several times at 10- to 15-minute intervals to ensure that the water levels have stabilized.

- Measure and record the depth to water and depth to the bottom of the well using an electric water level indicator tape.

8.0 GROUNDWATER pH, CONDUCTIVITY, TEMPERATURE, AND TURBIDITY MEASUREMENTS

8.1 Scope

The following procedure outlines the techniques used for the accurate field measurement of pH, specific conductance (conductivity), temperature, and turbidity using appropriate meters and electrodes.

8.2 Equipment

The following equipment will be utilized by field personnel during measurement activities:

- pH meter
- pH buffer solution
- Probe preservation solution
- Deionized water
- Conductance meter
- Conductance standards
- Temperature probe
- Temperature simulator

- Field notebook or field data sheets
- Turbidimeter

8.3 Procedures

8.3.1 Field Measurement of pH by Electrode

8.3.1.1 Electrode Preparation

All field analytical meters require a pre-field inspection to insure that the equipment components are complete and in proper working order.

1. Remove any salt deposits from the exterior of the probe by rinsing with deionized water.

2. Shake the electrode (like a clinical thermometer) to remove air bubbles.

3. Connect electrode to the meter.

8.3.1.2 Inspection and Calibration

Inspect and calibrate the meter in accordance with the manufacturer's instructions.

8.3.1.3 Sample Analysis

1. Collect sample in a disposable container.

2. Immerse pH probe in the sample.

3. Measure the pH in accordance with the meter manufacturer's instructions.

4. Record the pH and rinse the probe with deionized water.

5. Check the instrument for drift after every 2 to 4 hours (or according to site-specific workplan) by measuring the standard closest in the pH to the samples being measured. Record the reading in the field notebook or field data sheets. Recalibrate the instrument whenever the reading deviates more than the 0.10-pH units from the standard's manufactured value.

6. If the instrument does not calibrate within 0.1 pH units, consult the instruction manual. Recalibrate the instrument with a back up probe if necessary.

8.3.1.4 Electrode Storage

When storing up to one week, use electrode storage solution. A temporary solution can be made with 1 gram of KCI added to 200 ml of pH 7 buffer. (Storage of the electrode in distilled water will shorten the life of the probe!) If the probe will not be used for periods greater than one week, clean the electrode as directed in the manual, secure the protective cap, and store dry.

8.3.1.5 Electrode Maintenance

Refer to the pH instruction manual for cleaning and maintenance instructions.

8.3.2 Field Measurement of Specific Conductance by Electrode

8.3.2.1 Inspection and calibration

Inspect and calibrate the meter in accordance with the manufacturer's instructions.

8.3.2.2 Sample Analysis

1. Rinse the probe in deionized water, and then rinse the probe in the sample to be measured.

2. Immerse the probe into the sample.

3. Measure the conductance in accordance with the meter manufacturer's instructions.

8.3.2.3 Calibration Check

Check the instrument calibration every 4 hours by re-measuring a standard closest to the conductivity of the samples being measured.

8.3.3 Field Measurement of Temperature by Electrode

1. Prepare the temperature probe in accordance with the manufacturer's instructions.

2. Immerse the probe into the sample and allow a short time (10 to 20 seconds) for the temperature to stabilize.

3. Record the temperature reading displayed in the field notebook or field data sheet.

9.0 SAMPLE COLLECTION DOCUMENTATION

- Record field observations and measurements on field record forms. Record information concerning field activities and conditions directly and legibly in the field logbooks in ink. If an entry must be changed, do not obscure the original entry. Document the date, weather conditions, site activities, and personnel on site including visitors in the logbook.

- Record sample time, sample location, sample interval depth, sample number, and sample preservation method in field notebook. Identify soil samples by the sampling location and sample depth. For example, a soil sample from soil boring number B3 collected from a depth interval of 7 to 9 feet will be designated as B3 7-9 feet. Identify field samples with sample labels that list the date, sample identification, and BT^2, Inc. project number.

- Prepare COC forms that include sample number, sampling procedures, analysis required, the signature of the sampler, type of sample (grab or composite), number of containers, and signature blocks for all who handle the sample (with the exception of shipping personnel).

10.0 SAMPLE LABELING AND SHIPMENT

Attach a sample label to each individual sample bottle. The label shall include the field sample number, date/time of collection, type of analysis, sampler initials, and project name. Labels shall be annotated with waterproof, permanent ink. Fill out the COC form including the site name, sampler names/signatures, time/date of sampling (in military time), type of sample, and analyses requested. The completed COC form should be enclosed in a sealable plastic bag taped to the inside lid of the cooler that contains the samples listed on the form, after retaining the sampler's copy.

11.0 EQUIPMENT DECONTAMINATION

- Wash all non-disposable sampling tools in an Alconox solution followed by a clean water rinse. Use tap water from a public water supply or a clean supply well or distilled water for the final rinse. Sampling equipment will be air or towel dried between sampling locations.

- Collect all decontamination water for treatment and or disposal. Collect a representative sample for analyses of target compounds. Obtain analyses and consult the operator of the local publicly owned treatment works (POTW) to determine if the water may be discharged to the sanitary sewer system or into the POTW headwaters.

12.0 INVESTIGATIVE WASTE MANAGEMENT

12.1 Contaminant Impacted Soil

- All probing and drilling cuttings will be contained and sampled for appropriate handling, treatment, or disposal.

- Samples from the contained cuttings will be submitted for analyses of the contaminants of concern and the results will be compared to applicable standards.

- If the soil cuttings do not contain concentrations that exceed the applicable standards, the cuttings will be spread on the site or blended into landscaped areas. If soil cuttings contain contaminant concentrations that exceed applicable standards, the cuttings will be disposed or treated at a permitted facility.

12.2 Contaminant Impacted Groundwater or Decontamination Water

- Potentially contaminated groundwater will be generated during the development, purging, and sampling of the monitoring wells.

- Contaminant impacted decontamination water will be generated during the decontamination of drilling and sampling equipment.

- Development, decontamination, and purge water with FID/PID readings greater than 10 ppm or with concentrations of any compounds above the applicable maximum contaminant levels (MCLs) will be discharged to the local publicly owned wastewater treatment works (POTW) after obtaining written authorization from the POTW superintendent. Based on the approval granted by the POTW operator or superintendent, the water may be discharged directly to the nearest sanitary sewer connection or collected in 55-gallon drums to be disposed of at the headwaters of the treatment works. If permission to discharge the impacted water to the

POTW is not granted, the water will be contained and sampled for approved treatment at an alternate permitted treatment, storage, or disposal facility.

12.3 Free Product

Any free product collected from groundwater wells will be collected in 55-gallon or smaller drums that are approved for storage of flammable liquids. The free product will be properly treated or disposed of as a special waste or a hazardous waste as is appropriate.

13.0 AIR MONITORING FOR VOLATILE ORGANIC CHEMICALS

13.1 Photo-Ionization Detector and Flame-Ionization Detector

A PID or FID may be used to monitor the concentration of volatile organic chemicals in the ambient air on a work site. Perform air monitoring as required in the project Health and Safety Plan (HSP).

- Calibrate the PID or FID as described in **Section 4.0**.
- Hold PID or FID inlet in the worksite breathing zone until a stable reading is obtained.
- Collect samples at regular intervals, at a frequency appropriate for the likely concentration of contaminants of concern, ventilation at the site, temperature, and work activities.
- Record readings in field note book and alert workers to any elevated readings. If appropriate, take actions in accordance with the project HSP.

14.0 SLUG TESTING AND ANALYSIS

14.1 Purpose

The purpose of a slug test is to measure an aquifer's hydraulic conductivity in the vicinity of a monitoring well. In a slug test, water level measurements are collected at timed intervals after a volume is removed from or added to the well. The rate at which the water level returns to its original position is a function of the aquifer hydraulic conductivity. The larger the hydraulic conductivity, the faster the water level would return to its original position.

Due to the relatively small volume removed from a well (1 to 2 gallons), a slug test is only able to measure the hydraulic conductivity in the immediate area of the well screen. To estimate regional hydraulic conductivity, it is necessary to perform a pump test where water is actively pumped from the well for a set period.

14.2 Equipment

- slug (1-inch diameter solid PVC with a galvanized iron eyehook in the top end) or bailer
- nylon rope (a separate piece for each well)
- Instrumentation Northwest DL2 datalogger
- Instrumentation Northwest pressure transducer and cable
- collar to hold cable in place during test
- electric water level indicator
- decontamination equipment (e.g., Alconox, brushes, buckets, distilled water, and a source of clean tap water)

14.3 Procedure

Open the well and allow it to equilibrate with atmospheric pressure, if necessary. Before beginning the test, measure the depth to water and the total depth of water in the well (the height of the water column in the well). Decontaminate the slug, the pressure transducer, and the cable by washing in a clean tap water/Alconox solution, followed by a triple rinse with distilled water.

Prepare and use the transducer and datalogger in accordance with the manufacturer's instructions. Place the transducer in the well so that it is near, but not touching, the bottom, and secure the cable with the collar. Avoid clogging the end of the transducer with sediment (if there is any sediment in the well). Connect the transducer cable to the datalogger. Place the slug in the well, using a new length of rope. Avoid placing the slug below the transducer, as it may jostle the transducer as it is pulled.

Allow sufficient time for the water level in the well to re-equilibrate. Monitor the change in water level with the datalogger; when the water level is changing less than 0.01 feet every minute, equilibration is sufficient. Before pulling the slug, note the water level indicated by the logger, then note the exact time the slug is pulled. After pulling the slug, allow the well to recover until the water level is changing less than 0.01 feet per recording interval. The transducer and cable may now be disconnected from the logger and removed from the well. Before moving on to the next well, decontaminate all equipment (e.g., slugs, transducer/cable) using the procedure noted above.

14.4 Data Analysis

Several methods are available to determine hydraulic conductivity based on the data collected during the slug test. Commonly used methods include Hvorslev (1951), Bouwer and Rice (1976), and Cooper, et al. (1967). The Bouwer and Rice method is most frequently used because it is able to correct for partial penetration of the well (the well is not fully screened over the entire thickness of the aquifer).

The Bouwer and Rice method utilizes a modification of the Thiem equation for radial flow to a pumped well. The equation used in this method is shown below:

$$K = \{[rc2 \ln(re / rw)]/2L\}\ 1/t \ln(yo/yt)$$

Where:

K = hydraulic conductivity

yo = initial change in water level due to instantaneous removal of water from the well

yt = change in water level at time t

L = length of well screen

t = time

rc = radius of well casing

re = equivalent radius over which head loss occurs

rw= radius of well (including filter pack)

After field data for the slug tests on each well are reduced and graphed, manual curve matching will be utilized to insure that sand pack dewatering effects, late time data, and other outliers do not affect the computed solution of the above equation.

15.0 SITE MAPPING WITH GPS

15.1 Scope

This Standard Operating Procedure (SOP) outlines the procedure through which site maps are created using mapping-grade Global Positioning System (GPS) equipment.

15.2 Personnel Training and Qualifications

Personnel generating site maps with GPS equipment should be familiar with technical aspects and goals of the site prior to site mapping. Field personnel should be familiar with operation of the equipment.

15.3 Equipment Needed

1. Trimble ™ GPS Pathfinder Pro XR Receiver with Geo XT handheld and batteries
2. Tape measure

15.4 Procedures and Documentation

A. GPS Equipment Setup

1) Connect antenna, batteries, and Geo XT handheld to the Pro XR Receiver (backpack)

2) Turn on Geo XT handheld and start the TerraSync application

3) Select "setup" from the top left drop-down menu in TerraSync
   a) Click the "connect" button (if button says "disconnect", unit is already connected, proceed to step
   b) Select "GPS settings"
   c) Select "COM1" from the "GPS receiver port" pull-down menu
   d) Select "real-time settings"
   e) At choice 1 select "Integrated Beacon"
   f) At choice 2 select "Integrated WAAS"
   g) At choice 3 select "Use Uncorrected GPS"

4) Select "data" from the top left drop-down menu in TerraSync
   a) Select "new file" from the secondary drop-down menu
   b) Enter name of the new file, use the following format: "project number_yearmonthday". Write the filename in the fieldbook.
   c) Select "BT2 Standard" dictionary

B. Point Feature (boring, well, benchmark, etc.) Data Collection

1) Select "data" from the top left pull-down menu (if it is not currently showing)

2) Select the "feature name" for the feature you want to map
   a) Stand with the GPS antenna directly above the feature and stand still
   b) Select "create". Logging should begin. If logging is paused, select "options", and choose "log now" from the drop down menu. If logging is slower than one point per second, choose "logging interval" from the drop down menu and change to 1 second
   c) While GPS is logging, fill out attribute information (feature name, etc.)
   d) After logging at least 60 data points select "OK"
   e) Screen will display "feature saved" message. Move to next feature to map.

C. Point Feature Data Collection by Offset (For mapping building corners or features within 10 feet of a building or tall structure)

1) In the Data screen Select "Options" and choose "log later" from the drop down menu

2) Select the "feature name" for the feature you want to map
   a) Select "create". Logging will be paused.
   b) Select "options" and choose "offset" from the drop down menu
   c) Select "distance-distance" and click "next"
   d) Move to a location approximately 10 feet away from the feature, stand still, and click "log"
   e) After logging at least 60 data points, click "pause" then "next"
   f) Enter the horizontal distance between the feature and the point just logged (measure with tape measure), click "next"
   g) Move to a second location approximately 10 feet away from the feature, stand still, and click "log"
   h) After logging at least 60 data points click "pause" then "next"
   i) Enter the horizontal distance between the feature and point just logged (measure with tape measure), click "next"
   j) Determine whether the feature is to the right or the left as you walk from the first logged point to the second log point, choose "right" or "left", click "next"
   k) Fill out attribute information and click "ok"
   l) Screen will display "feature stored" message. Move to next feature to map.

D. Line Feature (utility, road, etc.) Data Collection

1) In the Data screen Select "Options" and choose "log later" from the drop down menu

2) Select the "feature name" for the feature you want to map

   a) Select "create". Logging will be paused.
   b) Stand at the beginning of the line feature to be mapped.
   c) Select "options" and choose "new vertex" from the drop down menu. Logging will begin
   d) After 20 data points have been logged, click "OK"
   e) If the feature is a straight line, move to a second point on the line and repeat steps "c" and "d" to log a second vertex. Log as many vertexes as desired to describe the line feature. Specifically log corners or distinct changes in direction. The GPS will draw straight lines between vertexes.
   f) If the feature contains curves that cannot be reasonable captured with vertexes, after logging the first vertex, click "log" and walk along the line. The GPS will log points as you walk.
   g) Click "pause" to stop logging for any reason. Click "log" to resume logging or select "options" and choose "new vertex" to collect another vertex position.
   h) Click "OK" to end collection of the line feature

15.5 Health and Safety Issues

Do not collect GPS data if lightning is present or could be present in the area. There are no other specific health and safety issues associated with this SOP. Refer to the site-specific health and safety plan for site-specific health and safety concerns and procedures.

15.6 Background

Site mapping is the foundation for all site work. Accurate site maps are necessary for all site investigation, remediation, and design activities. The objectives of the site mapping procedures are:

- To accurately and precisely present site information and features on a map; and
- To record site information for future use.

15.7 Limitations ON SOP Application

This SOP applies to sites where an adequate GPS signal is received. The GPS equipment will not accurately map indoors or in areas with significant overhead cover (trees, buildings, conveyors, etc.).

This SOP provides a description of the preferred way to complete GPS mapping in most situations. In some cases, the person performing site mapping may feel that an alternate approach would be more appropriate. In general, the SOP should be followed wherever feasible. However, the SOP is not intended to completely override the judgment of the technical person doing the work.

If the SOP for the task will not be followed, the person performing the work should:

- Obtain approval for the deviation from the SOP from the project manager if time permits. If the project manager is not available, request approval from a senior staff person familiar with the technical area of the SOP.

- Document deviations from the SOP. Documentation should include the reasons for the change in procedure and a detailed description of the changes.

16.0 PROCESSING GPS MAPPING DATA

16.1 Scope

This Standard Operating Procedure (SOP) outlines the procedure through which Global Positioning System (GPS) mapping data are processed and checked for quality assurance and quality control (QA/QC) purposes.

16.2 Personnel Training and Qualifications

Personnel processing GPS data should be familiar with technical aspects of the global positioning system, GPS equipment, and GPS data collection and processing. Personnel should receive training prior to processing GPS data.

16.3 Equipment Needed

1. Geo XT handheld unit
2. Computer with GPS Pathfinder Office software, Windows Explorer, Microsoft Excel

16.4 Procedures and Documentation

A. Transfer Data from Geo XT to the Desktop Computer

1) Open GPS Pathfinder Office software (Pathfinder)

2) The Pathfinder Project Window will open automatically.
   a) If the data to be transferred were collected for a project with an exiting GPS folder, select the existing project
   b) If the data to be transferred were collected for a new GPS project, create a new project in the project window. All projects with GPS data should have a GPS folder created in the "I:" drive (e.g. I:\Project#\GPS\)

3) Take the Geo XT out of the cradle, turn it on, and place back in the cradle. The Geo XT will communicate with the computer via USB. Select "no" when prompted to set up a partnership.

4) Select the "data" pull-down menu in Pathfinder and choose "transfer"
   a) Select the "receive" tab (to receive data from the Geo XT)
   b) Select "add"
   c) Select "data file" from the drop-down menu
   d) Select the file you want to transfer from the Geo XT to the computer (file type is .ssf)
   e) Select "transfer all"
   f) After the transfer is complete close the transfer windows
   g) Use Windows Explorer to rename the file if the BT2 convention was not used (Project#_yearmonthday.ssf)
   h) Use Windows Explorer to make the transferred file "read only"
   i) Once the file transfer is confirmed, delete the file from the Geo XT.

5) Optional step – view transferred data
   a) In Pathfinder, select the "file" drop-down menu and choose "open"
   b) Navigate to the transferred file and open it. Review data as desired, then close the file.

B. Differential Correction of Data

1) In Pathfinder, select the "data" pull-down menu and choose "differential correction". The file to be differentially corrected does not need to be open in Pathfinder. The differential correction window will open.
   a) Under "rover files" browse for the desired .ssf file if it is not already selected.

b) Under "base files" select "internet search"

c) If you know which base station is closest to the site at which the data was collected, select it from the drop down menu under "base data provider" and proceed to step "j". If you do not know the closest base station, proceed to step "d".

d) Select "new"

e) In the "new provider" window, select "copy the most up-to-date . ."

f) Select "yes" in the "confirm internet setup" window. A list of base stations with distances to the subject site will be downloaded.

g) Select the closest base station and click "OK"

h) If prompted to "overwrite existing base provider" choose "yes"

i) Click "OK" to close the "provider properties" window

j) Click "OK" in the "internet search" window

k) Select "yes" in the "confirm internet setup" window. Internet base files will download.

l) When the file download is complete, the "confirm selected base files" window will open. The window should indicate 100% coverage. If coverage is not 100% and it has been at least a day since the data were collected, go back to step "c" and choose the next closest base station.

m) Click "OK" in the "reference position" window

n) Click "OK" in the "differential correction" window. Differential correction will proceed. Differential correction will take several minutes depending on the amount of data collected.

o) The "differential correction completed" window will show a summary. Coverage should again be 100%. Click "close" to close this window.

p) The differential correction process creates a new file with the same name as the .ssf file, but with the extension .cor. Use Windows Explorer to navigate to the new .cor file and make it read only.

C. Review Data for QA/QC Purposes

1) In Pathfinder, select the "file" pull-down menu and choose "open". Browse to the desired file (.cor) and open it.

2) Select the "file" pull-down menu and choose "save as". Save the file using the following naming convention: Project#_QC_yearmonthday.cor. The date reference should be the date of data collection, consistent with the other filenames for the data.

3) Use the "feature property" window to view properties for each feature. Specifically review the standard deviation and horizontal precision for each feature. If the standard deviation and horizontal precision for a feature are both less than 1, not further review is needed for that feature. If the standard deviation or horizontal precision are greater than 1, proceed to step 4.

4) Review position data
   a) Select the "view" pull-down menu choose "layers" then "features"
   b) Select "not in feature"
   c) Select "line style". Select the color red and increase the line weight to be greater than the default.
   d) Click "ok" to close window.
   e) Select the desired feature in the "feature properties" box
   f) Click "delete", the feature will be temporarily deleted and replaced by the individual position data (red dots) collected by the GPS
   g) In the "map" window, zoom in on the data points that make up the feature
   h) Use the "position properties" window to review position data for each point. Review standard deviation, horizontal precision, visual position, number of satellites, and DOPs to determine if some points are better than others.
   i) If position data points are identified as poor quality (high standard deviation, high horizontal precision, lower number of satellites, high DOPs, or poor visual position as compared to the other position data points), use the eraser tool to delete the poor quality position data points. It is possible that none of the data points will stand out as poor quality. In that case, no action is required.
   j) When editing of position data is finished, click "undelete" in the "feature property" window. The feature will be restored. If data points were deleted, new values for standard deviation and horizontal precision will be calculated in the "feature property" window.
   k) Repeat steps e through j for all features. Save the file periodically and when finished.

D. Export Data to Excel File

1) In Pathfinder select the "utilities" drop-down menu and choose "export"
2) In the export window select "sample dbase setup" from the drop down menu
3) Click "properties". Verify that the desired coordinate system is selected. BT2 standard practice is to use Universal Transverse Mercator (UTM), NAD 1983 conus datum, units in feet, and mean sea level for altitude reference. Deviations from standard practice will

be necessary if the GPS data will be used with a base map in a different coordinate system. The export coordinate system should always match the coordinate system of the intended use of the data.

4) When export properties are confirmed click "OK" to exit the properties window
5) In the export window add file path information for export file destination. Add "database" to the existing export directory (e.g., I:\Project#\GPS\Export\Database).
6) Click "OK" to export. When prompted to create the new database folder select "yes". Pathfinder will create a separate database file (.dbf) for each feature type collected and place it in the database folder just created.
7) Close the "export completed" window.
8) Open the MS Excel database template file located at Q:\GPS\metadata_gps_data-template.xls.
9) Save the template file in the database folder with filename Metadata_gps_yearmonthday.xls (the date included in the filename should be the date of data collection).
10) Open all of the exported database files in MS Excel. The files are located at I:\Project#\GPS\Export\Database.
11) Copy each of the database files into the Metadata file.
12) Fill in the project information in the "read me" worksheet of the Metadata file. Save the Excel file.
13) After all database files are saved in the Metadata Excel file, use Windows Explorer to delete the database files (.dbf files) from the Database folder.

E. Export to AutoCad

1) In Pathfinder select the "utilities" drop down menu then choose "export"
2) In the export window select "sample AutoCad DXF Setup without blocks" from the drop-down menu
3) Click "properties". Verify that the desired coordinate system is selected. BT2 standard practice is to use Universal Transverse Mercator (UTM), NAD 1983 conus datum, units in feet, and mean sea level for altitude reference. Deviations from standard practice will be necessary if the GPS data will be used with a base map in a different coordinate system. The export coordinate system should always match the coordinate system of the intended use of the data.
4) When export properties are confirmed click "OK" to exit the properties window

5) In the export window add file path information for export file destination. Add "AutoCad" to the existing export directory (e.g., I:\Project#\GPS\Export\AutoCad).

6) Click "OK" to export. When prompted to create the new AutoCad folder select "yes". Pathfinder will create a .dxf file and place it in the AutoCad folder just created.

7) Close the "export completed" window

16.5 Health and Safety Issues

There are no health and safety issues associated with this SOP.

16.6 Background

GPS mapping data need to be accurate to make and edit accurate site maps. The objectives of this GPS mapping data processing procedure are:

- To review the quality of GPS mapping data; and
- To prepare GPS mapping data for use in site maps.

16.7 Limitations on SOP Application

This SOP applies to GPS data collected with the Trimble GPS Pathfinder Pro XR system with Geo XT handheld. Data collected with a different system will require a different procedure. Only personnel who have received training for this SOP should implement this SOP.

This SOP provides a description of the preferred way to complete GPS data processing in most situations. In some cases, the person performing data processing may feel that an alternate approach would be more appropriate. In general, the SOP should be followed wherever feasible. However, the SOP is not intended to completely override the judgment of the technical person doing the work.

If the SOP for the task will not be followed, the person performing the work should:

- Obtain approval for the deviation from the SOP from the project manager if time permits. If the project manager is not available, request approval from a senior staff person familiar with the technical area of the SOP.

- Document deviations from the SOP. Documentation should include the reasons for the change in procedure and a detailed description of the changes.

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APPENDIX E

Appendix IX Inorganics List

Appendix E

List of Inorganic Compounds from 40 CFR Part 264 Appendix IX

Antimony
Arsenic
Barium
Beryllium
Cadmium
Chromium
Cobalt
Copper
Lead
Mercury
Nickel
Selenium
Silver
Sulfide
Thallium
Tin
Vanadium
Zinc

APPENDIX F

Example Field Forms

BT², Inc.
Environmental Engineering and Science

SOIL BORING LOG INFORMATION

10-92

Facility/Project Name BT²#			License/Permit/Monitoring Number		Boring Number ...
Boring Drilled By (Firm name and name of crew chief)			Drilling Started	Drilling Completed	Drilling Method
Facility Well No.	Unique Well No.	Common Well Name	Static Water Level Feet	Surface Elevation Feet	Borehole Diam. Inches
Boring Location State Plane N, E NE 1/4 of NE 1/4 of Section , T. N., R. E.			Lat. Long.	Local Grid Location (If applicable)	
County			Location Code	Civil Town/City/or Village	

Sample: Number	Sample: Length Recovered	Sample: Blow Counts	Depth in Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	USCS	Graphic Log	Well Diagram	Max. PID/FID	Soil Properties: Standard Penetration	Soil Properties: Moisture Content	Soil Properties: P200	RQD/ Comments
			5									
			10									
			15									
			20									
			25									

I hereby certify that the information on this form is true and correct to the best of my knowledge.

Signature	Firm BT², Inc.

BT², Inc.

Boring Number ...

Sample: Number	Sample: Length Recovered	Sample: Blow Counts	Depth in Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	USCS	Graphic Log	Well Diagram	Max. PID/FID	Soil Properties: Standard Penetration	Soil Properties: Moisture Content	Soil Properties: P200	RQD/ Comments
			30									
			35									
			40									
			45									
			50									
			55									
			60									
			65									

BT², Inc.
Environmental Engineering and Science

Watershedwater ☐ Waste Management ☐
Remediation ☐ Other ☐ ________

MONITORING WELL CONSTRUCTION
Form GEN-CONS -A Rev. 4-2002

Facility/Project Name	Local Grid Location of Well ______ ft. ☐N. ☐S. ______ ft. ☐E. ☐W.	Well Name
Facility License,Permit or Monitoring Number	Local Grid Origin ☐ (estimated: ☐) or Well Location ☐ Lat. __° __' __" Long. __° __' __" or St.Plane ________ ft. N. ________ ft. S.	Unique Well Number ________ | Well ID No. ___
Facility ID __________	Section Location of Waste/Source __1/4 of __1/4 of Sec. __,T. __N,R. __ ☐E. ☐W.	Date Well Installed __/__/____ (m m / d d / y y y y)
Type of Well Well Code ______/______		Well Installed By: Name (first, last) and Firm)
Distance From Waste/ Source ______ ft. | Enf. Stds. Apply ☐	Location of Well Relative to Waste/Source u ☐Upgradient s ☐Sidegradient d ☐Downgradient n ☐Not Known | Gov. Lot Number	______________ ______________

A. Protective pipe, top elevation ____.__ ft. MSL
B. Well casing, top elevation ____.__ ft. MSL
C. Land surface elevation ____.__ ft. MSL
D. Surface seal, bottom ____.__ ft. MSL or __.__ ft.

12. USCS classification of soil near screen:
GP ☐ GM ☐ GC ☐ GW ☐ SW ☐ SP ☐
SM ☐ SC ☐ ML ☐ MH ☐ CL ☐ CH ☐
Bedrock ☐

13. Sieve analysis attached? ☐Yes ☐No

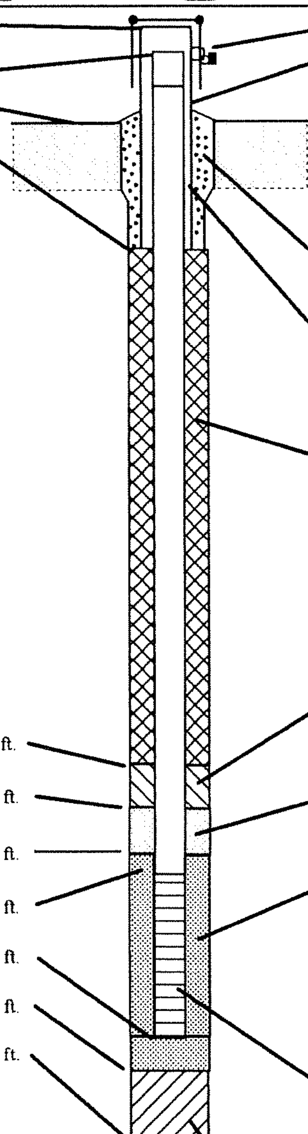
14. Drilling method used: Rotary ☐5 0
Hollow Stem Auger ☐4 1
Other ☐ ______________

15. Drilling fluid used: Water ☐0 2 Air ☐0 1
Drilling Mud ☐0 3 None ☐9 9

16. Drilling additives used? ☐Yes ☐No
Describe ______________

17. Source of water (attach analysis, if required):
____

E. Bentonite seal, top ____.__ ft. MSL or ___.__ ft.
F. Fine sand, top ____.__ ft. MSL or ___.__ ft.
G. Filter pack, top ____.__ ft. MSL or ___.__ ft.
H. Screen joint, top ____.__ ft. MSL or ___.__ ft.
I. Well bottom ____.__ ft. MSL or ___.__ ft.
J. Filter pack, bottom ____.__ ft. MSL or ___.__ ft.
K. Borehole, bottom ____.__ ft. MSL or ___.__ ft.
L. Borehole, diameter __.__ in.
M. O.D. well casing __.__ in.
N. I.D. well casing __.__ in.



1. Cap and lock? ☐Yes ☐No
2. Protective cover pipe:
   a. Inside diameter: __.__ in.
   b. Length: __.__ ft.
   c. Material: Steel ☐0 4 Other ☐ ______________
   d. Additional protection? ☐Yes ☐No
   If yes, describe: ______________
3. Surface Seal Bentonite ☐3 0 Concrete ☐0 1 Other ☐ ______________
4. Material between well casing and protective pipe: Bentonite ☐3 0 Other ☐ ______________
5. Annular space seal: a. Granular/Chipped Bentonite ☐3 3
   b. ____Lbs/gal mud weight...Bentonite-sand slurry ☐3 5
   c. ____Lbs/gal mud weight...........Bentonite slurry ☐3 1
   d. ____% Bentonite..........Bentonite-cement grout ☐5 0
   e. ______ Ft^3 volume added for any of the above
   f. How installed: Tremie ☐0 1 Tremie pumped ☐0 2 Gravity ☐0 8
6. Bentonite seal: a. Bentonite granules ☐3 3
   b. ☐1/4 in. ☐3/8 in. ☐ 1/2 in. Bentonite chips ☐3 2
   c. ______________ ☐
7. Fine sand material: Manufacturer, product name & mesh size
   a. ______________ ☐
   b. Volume added ________ ft^3
8. Filter pack material:Manufacturer, product name & mesh size
   a. ______________ ☐
   b. Volume added ________ ft^3
9. Well casing: Flush threaded PVC schedule 40 ☐2 3
   Flush threaded PVC schedule 80 ☐2 4
   ______________ ☐
10. Screen material ______________
   a. Screen type: Factory cut ☐0 1 Continuous slot ☐0 2 Other ☐ ______________
   b. Manufacturer ______________
   c. Slot size: 0.___ in.
   d. Slotted length: __.__ ft.
11. Backfill material (below filter pack): None ☐1 4 Other ☐ ______________

I hereby certify that the information on this form is true and correct to the best of my knowledge.

Signature	Firm BT², Inc., 2830 Dairy Drive, Madison, WI 53704-6751

Please complete both Well Construction and Well Development Forms and return them to the appropriate parties

BT², Inc.
Environmental Engineering and Science

MONITORING WELL DEVELOPMENT
Form GEN-CONS-B Rev. 4-2002

Watershed ☐ Waste Management ☐
Remediation ☐ Other ☐ ____________

Facility/Project Name	County Name	Well Name
Facility License, Permit or Monitoring Number	County Code __	Unique Well Number ________ / Well Number ___

1. Can this well be purged dry? ☐ Yes ☐ No

2. Well development method
   - surged with bailer and bailed ☐ 4 1
   - surged with bailer and pumped ☐ 6 1
   - surged with block and bailed ☐ 4 2
   - surged with block and pumped ☐ 6 2
   - surged with block, bailed and pumped ☐ 7 0
   - compressed air ☐ 2 0
   - bailed only ☐ 1 0
   - pumped only ☐ 5 1
   - pumped slowly ☐ 5 0
   - Other____________ ☐ __

3. Time spent developing well ____ min.

4. Depth of well (from top of casing) ___._ ft.

5. Inside diameter of well __.__ in.

6. Volume of water in filter pack and well casing ___._ gal.

7. Volume of water removed from well ___._ gal.

8. Volume of water added (if any) ___._ gal.

9. Source of water added ____________

10. Analysis performed on water added? ☐ Yes ☐ No
    (if yes, attach results)

		Before Development	After Development
11. Depth to Water (from top of well casing)	a.	___.__ ft.	___.__ ft.
Date	b.	__/__/____ mm dd yyyy	__/__/____ mm dd yyyy
Time	c.	__:__ ☐ a.m ☐ p.m	__:__ ☐ a.m ☐ p.m
12. Sediment in well bottom		__._ inches	__._ inches
13. Water clarity		Clear ☐ 1 0 Turbid ☐ 1 5 (Describe)	Clear ☐ 2 0 Turbid ☐ 2 5 (Describe)

Fill in if drilling fluids were used and well is at solid waste facility:

	Before Development	After Development
14. Total suspended solids	____._ mg/l	____._ mg/l
15. COD	____._ mg/l	____._ mg/l

16. Well Developed by: Name (first, last) and Firm
First Name: Last Name:
Firm:

17. Additional comments on development:

Name and Address of Facility Contact/Owner/Responsible Party
First Name: ____________ Last Name: ____________
Firm: ____________
Street: ____________
City/State/Zip: ____________

I hereby certify that the above information is true and correct to the best of my knowledge.

Signature: ____________
Print Name ____________
Firm: BT², Inc., 2830 Dairy Drive, Madison, WI 53704-6751

See instructions for more information including a list of county codes and well types.

BT² , Inc.
Environmental Engineering and Science

WELL/DRILLHOLE/BOREHOLE ABANDONMENT

(1) GENERAL INFORMATION

Well/Drillhole/Borehole Location | County

____ 1/4 of ____ 1/4 of Sec. ____ ; T. ____ N;R ____ ☐ E. ☐ W.

(If applicable)
________ Gov't Lot ________ Grid Number

Grid Location
________ ft. ☐ N. ☐ S. ________ ft. ☐ E. ☐ W.

Civil Town Name

Street Address of Well

City, Village

(2) FACILITY NAME

Original Well Owner (If Known)

Present Well Owner

Street or Route

City, State, Zip Code

Facility Well No. and/or Name (If Applicable) | WI Unique Well No. _ _ _ _ _

Reason For Abandonment

Date of Abandonment

WELL/DRILLHOLE/BOREHOLE INFORMATION

(3) Original Well/Drill/Borehole Construction Completed On
(Date) ________

☐ Monitoring Well
☐ Water Well
☐ Drillhole
☐ Borehole

Construction Report Available?
☐ Yes ☐ No

Construction Type:
☐ Drilled ☐ Driven (Sandpoint) ☐ Dug
☐ Other (Specify) ________

Formation Type:
☐ Unconsolidated Formation ☐ Bedrock

Total Well Depth (ft.) (From groundsurface) ____ Casing Diameter (ins.) ____
Casing Depth (ft.) ____

Lower Drillhole Diameter (in.) ____

Was Well Annular Space Grouted? ☐ Yes ☐ No ☐ Unknown

If Yes, To What Depth? ________ Feet

(4) Depth to Water (Feet) ________

Pump & Piping Removed? ☐ Yes ☐ No ☐ Not Applicable
Liner(s) Removed? ☐ Yes ☐ No ☐ Not Applicable
Screen Removed? ☐ Yes ☐ No ☐ Not Applicable
Casing Left in Place? ☐ Yes ☐ No ☐ Not Applicable
If No, Explain ________

Was Casing Cut Off Below Surface? ☐ Yes ☐ No
Did Sealing Material Rise to Surface? ☐ Yes ☐ No
Did Material Settle After 24 Hours? ☐ Yes ☐ No
If Yes, Was Hole Retopped? ☐ Yes ☐ No

(5) Required Method of Placing Sealing Material
☐ Conductor Pipe-Gravity ☐ Conductor Pipe-Pumped
☐ Dump Bailer ☐ Other(Explain)

(6) Sealing Materials
☐ Neat Cement Grout
☐ Sand-Cement (Concrete) Grout
☐ Concrete
☐ Clay-Sand Slurry
☐ Bentonite-Sand Slurry
☐ Chipped Bentonite

For monitoring wells and monitoring well boreholes only
☐ Bentonite Pellets
☐ Granular Bentonite
☐ Bentonite -Cement Grout

(7) Sealing Material Used	From (Ft.)	To (Ft.)	No. Yards, Sacks Sealant or Volume	Mix Ratio or Mud Weight
	Surface			

(8) Comments: ________

(9) Name of Person or Firm Doing Sealing

Signature of Person Doing Work	Date Signed
Street or Route	Telephone Number ( )
City, State, Zip Code	

GROUNDWATER SAMPLING AND/OR GROUNDWATER ELEVATION MEASUREMENT FORM

Site Name	**Permit No.**
Monitoring Well/Piezometer No.	
Upgradient	**Downgradient**
Name of person sampling	

A. MONITORING WELL/PIEZOMETER CONDITIONS		
Well/Piezometer Properly Capped? (please circle)	**YES**	**NO**
If no, explain		
Standing Water or Litter? (please circle)	**YES**	**NO**
If yes, explain		

B. GROUNDWATER ELEVATION MEASUREMENT (± 0.01 foot, MSL)			
Elevation:			
Top of inner well casing		**Ground Elevation**	
Depth of Well		**Inside Casing Diameter (in inches)**	
Equipment Used			
Groundwater Level (± 0.01 foot below top of inner casing, MSL):			
	Date/Time	**Depth to Groundwater**	**Groundwater Elevation**
Before Purging			
***After Purging**			
***Before Purging**			

***C. WELL PURGING**	
Quantity of Water Removed from Well (gallons)	
No. of Well Volumes (based on current water level)	
Was well pumped/bailed dry?	
Equipment used:	
Bailer type	**Dedicated Bailer?**
Pump type	**Dedicated Pump?**
If not dedicated, method of cleaning	

***D. FIELD MEASUREMENT**	
Weather Conditions	
Field Measurements (after stabilization):	
Temperature	**Units**
Equipment Used	
pH	
Equipment Used	
Specific Conditions	**Units**
Equipment Used	

Comments

CERTIFICATION

I certify under penalty of law I believe the information reported above is true, accurate and complete.

Signature		**Date**
Telephone	**Fax**	**Email**

NOTE: Attach Laboratory Report and 8-1/2" x II" site plan showing locations of all surface and groundwater monitoring points. One map per sampling round.

*Omit if only measuring groundwater elevations.

Ground Water Sampling Log

Site Name: **Well #:** **Date:**

Well Depth(Ft-BTOC[1]): **Screen Interval**(Ft):

Well Dia.: **Casing Material:** **Sampling Device:**

Pump placement(Ft from TOC[2]):

Measuring Point: **Water level (static)**(Ft):

Water level (pumping)(Ft): **Pump rate**(Liter/min):

Sampling Personnel:

Other info: (such as sample numbers, weather conditions and field notes)

Water Quality Indicator Parameters

Time	Pumping rates (L/Min)	Water level (ft)	DO (mg/L)	ORP (mv)	SEC[3]	Turb. (NTU)	pH	Temp. (C^0)	Volume pumped (L)

Type of Samples collected:

1 casing volume was:
Total volume purged prior to sample collection:
[1]BTOC-Below Top of Casing
[2]TOC-Top of Casing
[3]Specific Electrical Conductance

Stabilization Criteria

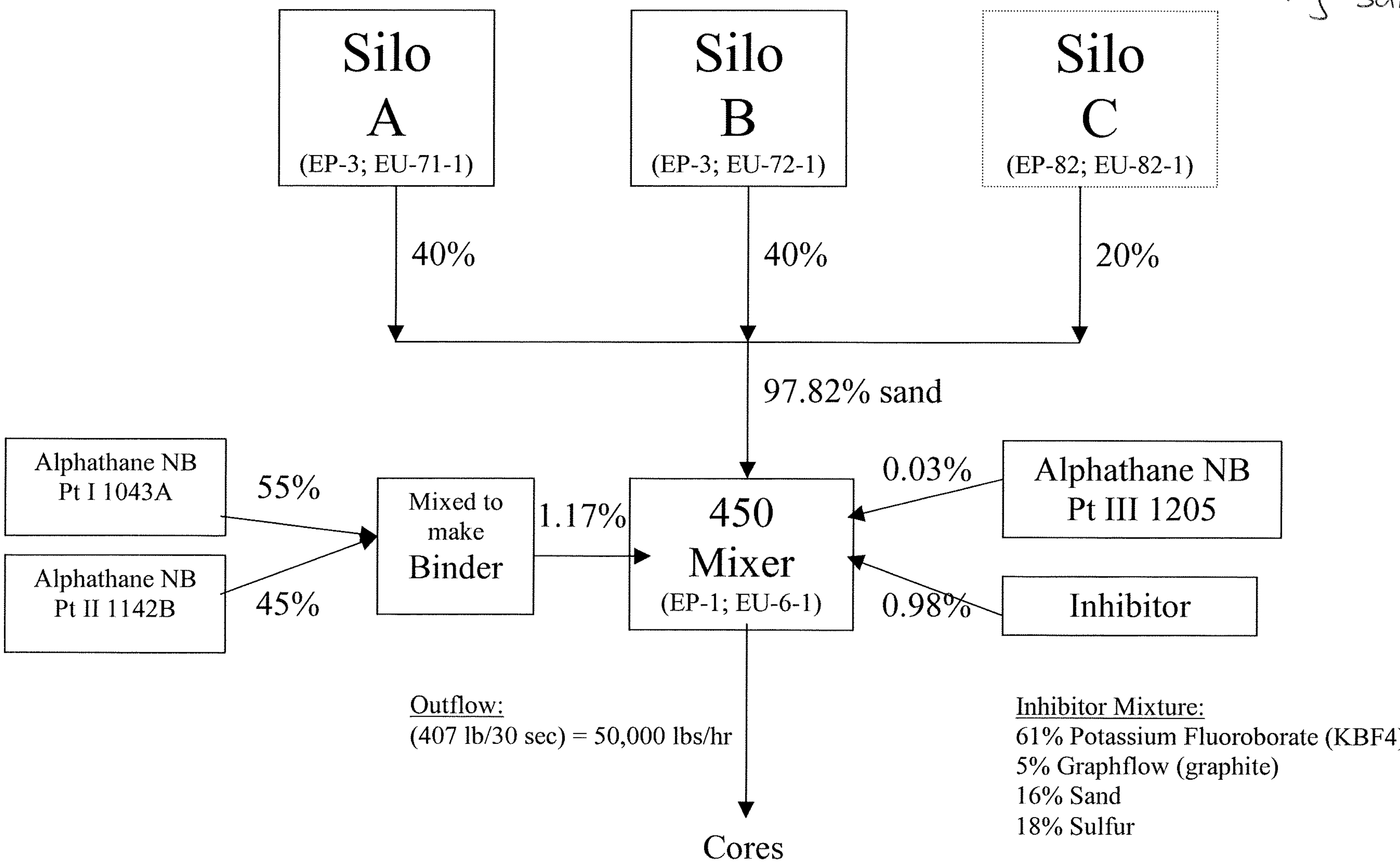
D.O.	+/- 0.3 mg/l
Turb.	+/- 10%
S.C.	+/- 3%
ORP	+/- 10 mV
pH	+/- 0.1 unit

APPENDIX G

Foundry Sand Information

Dry Sand Information

Sample flow chart for dry sand



H-1 F-2 R-1

MATERIAL SAFETY DATA SHEET

SECTION 1 CHEMICAL PRODUCT and COMPANY IDENTIFICATION

Product Name: Alphathane NB 1043A Pt I

Manufacturer and Supplier Information
Alpha Resins, Inc.
17350 Ryan Road
Detroit, MI 48212
313-366-9300

For Chemical Emergency, Spill, Leak, Fire, Exposure, or Accident, call **CHEMTREC** – Day or Night
800-424-9300

SECTION 2 COMPOSITION / INFORMATION on INGREDIENTS

Component	CAS Number	Range % by Weight
Phenolic Resin	9003-35-4	50 - 55
Phenol	108-95-2	<6.5
Aromatic Petroleum Distillate	64742-94-5	10 - 20
Aromatic Petroleum Distillate	64742-95-6	10 - 20
Naphthalene	91-20-3	1 - 3
1,2,4-Trimethylbenzene	95-63-6	1 - 5
Ester solvents	1119-40-0 & 627-93-0 & 106-65-0	10 - 15

SECTION 3 HAZARDS IDENTIFICATION

EMERGENCY OVERVIEW: Harmful by inhalation, in contact with skin and if swallowed. Irritating to eyes and skin.

POTENTIAL HEALTH EFFECTS

EYE CONTACT: May cause eye irritation, redness, pain, inflammation, blurred vision or corneal opacity. Concentrations of 10 ppm in humans can be tolerated without significant eye irritation.

SKIN CONTACT: Frequent or prolonged contact may cause moderate irritation, stinging, defatting of skin and dermatitis.

INHALATION: May cause respiratory tract irritation, headache, nausea and dizziness.

INGESTION: May cause irritation of the mouth and stomach and central nervous system, vomiting and diarrhea. Aspiration of the material into lungs can cause chemical pneumonitis which can be fatal.

SECTION 3 HAZARDS IDENTIFICATION cont'd

HMIS RATING			NFPA CODE		
HEALTH	=	1	HEALTH	=	1
FLAMMABILITY	=	2	FLAMMABILITY	=	2
REACTIVITY	=	1	REACTIVITY	=	1

SECTION 4 FIRST AID MEASURES

EYE CONTACT: Flush eyes immediately for 15 minutes with copious amounts of water. Hold eyelids open and roll eyes to ensure complete washing. Get prompt medical attention.

SKIN CONTACT: Wash immediately with large amounts of water and soap, if available. Remove contaminated clothing, including shoes, and launder before reuse.

INHALATION: Using proper respiratory protection, immediately move the exposed person to fresh air. Administer artificial respiration if breathing is stopped. Call for immediate medical attention.

INGESTION: If swallowed DO NOT INDUCE VOMITING. Call for immediate medical attention. Aspiration of the material into the lungs can cause chemical pneumonitis which can be fatal.

NOTE TO PHYSICIAN: No specific antidote. Treat symptomatically and supportively.

SECTION 5 FIRE-FIGHTING MEASURES

FLASH POINT (PMCC):	110°F
LOWER EXPLOSION LIMIT:	0.6% for aromatic hydrocarbon
UPPER EXPLOSION LIMIT:	7.0% for aromatic hydrocarbon
AUTOIGNITION TEMPERATURE:	Not determined
FLAMMABILITY CLASSIFICATION:	II
FIRE-FIGHTING EQUIPMENT:	Wear positive pressure self-contained breathing apparatus and full turnout gear.
EXTINGUISHING MEDIA:	Dry chemical, water spray, or regular foam.
PRECAUTIONS:	Take precautionary measures against static discharge.

SECTION 5 FIRE-FIGHTING MEASURES cont'd

HAZARDOUS COMBUSTION PRODUCTS:	Carbon monoxide, and/or carbon dioxide, and unknown organic compounds in black smoke.
UNUSUAL FIRE AND EXPLOSION HAZARDS:	Moderate fire hazard when exposed to heat or flame. Vapors are heavier than air and can travel a considerable distance to a source of ignition and flash back.

SECTION 6 ACCIDENTAL RELEASE MEASURES

Evacuate and ventilate spill area. Wear appropriate Personal Protective Equipment (PPE) including respiratory equipment during clean-up.

For small spills: contain/absorb spilled liquid with inert material (e.g. sand or vermiculite). Do not use combustible materials such as sawdust. Place recovered material in appropriate container (open top).
Major spill: Call Alpha Resins (313) 366-9300. If temporary control of vapor is required, a blanket of protein foam may be placed over the spill. Large quantities may be placed into closed, but not sealed drums for disposal. Spill should be contained by diking, to prevent run-off and contamination of ground water, soil, storm drains, or sewers. Consult an expert on disposal of recovered material and ensure conformity to local disposal regulations.

SECTION 7 STORAGE and HANDLING

STORAGE: Store indoors at 75-105° F in original, unopened containers. Protect from atmospheric moisture. Keep separate from combustibles and other reactive materials.

HANDLING: Handle with care, in accordance with good industrial hygiene and safety practices. Wear proper protective clothing and rubber gloves if possibility of contact exists. Do NOT handle near an open flame, heat, or other sources of ignition. Do NOT pressurize, cut, or weld containers. Empty product containers may contain product residue. Do NOT reuse empty containers without commercial cleaning or reconditioning. Fixed equipment, as well as transfer containers and equipment should be grounded to prevent accumulation of static charge.

SECTION 8 EXPOSURE CONTROLS / PERSONAL PROTECTION

EXPOSURE CONTROLS: Use of local exhaust ventilation is recommended to control emissions near the source. Atmospheric levels should be maintained below the exposure guideline. When respiratory protection is required for certain operations, use an approved positive-pressure supplied air respirator. Laboratory samples should be handled in a lab hood. Provide mechanical ventilation of confined spaces.

PERSONAL PROTECTION: For open systems where contact is possible, wear safety glasses with side shields/chemical goggles, long sleeves, and chemically resistant gloves. Where adequate ventilation is not possible, a NIOSH/MSHA approved air-purifying respirator or an air line-supplied respirator should be used.

EXPOSURE GUIDELINES:

		Exposure Limits	
Component	CAS Number	OSHA-PEL	ACGIH-TLV
Phenolic Resin	9003-35-4	None established	None established
Phenol	108-95-2	5 ppm (skin)	5 ppm (skin)
Aromatic Petroleum Distillate	64742-94-5	None established	None established
Aromatic Petroleum Distillate	64742-95-6	None established	None established
Naphthalene	91-20-3	20 ppm	10 ppm
1,2,4-Trimethylbenzene	95-63-6	25 ppm	25 ppm
Ester solvents	1119-40-0 & 627-93-0 & 106-65-0	None established	None established

SECTION 9 PHYSICAL and CHEMICAL PROPERTIES

APPEARANCE	Viscous liquid
ODOR	Characteristic phenolic
pH	Not applicable
VAPOR PRESSURE	0.15 mm Hg @ 100°F
BOILING POINT	305-340°F
MELTING POINT	Not applicable
SOLUBILITY IN WATER	Nil
SPECIFIC GRAVITY	1.05 - 1.15

SECTION 10 STABILITY and REACTIVITY

STABILITY	Stable under normal temperature and pressure.
CONDITIONS TO AVOID INSTABILITY	None under normal conditions.
MATERIALS TO AVOID INSTABILITY	Strong mineral and organic acids.
HAZARDOUS DECOMPOSITION PRODUCTS	May yield toxic oxides of carbon.
HAZARDOUS POLYMERIZATION	Will not occur.

SECTION 11 TOXICOLOGICAL INFORMATION

ACUTE TOXICITY DATA

EYE IRRITATION	Moderate irritant
SKIN IRRITATION	Moderate irritant
DERMAL LD50	669 mg/kg Phenol - Rat
ORAL LD50	317 mg/kg Phenol - Rat
INHALATION LC50	316 mg/4 hours Phenol - Rat

OTHER TOXICITY DATA	None known at this time

SECTION 12 ECOLOGICAL INFORMATION

No additional information known.

SECTION 13 DISPOSAL CONSIDERATIONS

Dispose in accordance with all applicable Federal, State, and local regulations.

SECTION 14 TRANSPORT INFORMATION

U.S. DEPARTMENT OF TRANSPORTATION

DOT Not Regulated in containers less than 110 gallons.

For containers greater than 110 gallons:

Combustible Liquids, N.O.S., 3, NA 1993, PG III (aromatic hydrocarbon)

INTERNATIONAL INFORMATION

Not regulated

SECTION 15 REGULATORY INFORMATION

U.S. FEDERAL REGULATIONS

CERCLA
SECTIONS 102A/103 - HAZARDOUS SUBSTANCES (40 CFR PART 302.4)
This product contains Phenol (108-95-2) and Naphthalene (91-20-3). The RQ for this product is 6600#.

SARA TITLE III
SECTION 302 - EXTREMELY HAZARDOUS SUBSTANCES (40 CFR PART 355)
Phenol

SECTION 311/212 - HAZARDOUS CATEGORIZATION (40 CFR PART 370)
Acute health

SECTION 313 - 40 CFR PART 372

Phenol	108-95-2	< 6.5%
Naphthalene	91-20-3	< 1.5%
1,2,4-Trimethylbenzene	95-63-6	< 5.0%

TSCA
All components on inventory

OSHA HAZARD COMMUNICATION STANDARD
Irritant

SECTION 15 REGULATORY INFORMATION cont'd

CANADIAN REGULATIONS

WHMIS CONTROLLED PRODUCT CLASSIFICATION
B3, D2B

EINECS/ELINCS
Not known

DOMESTIC SUBSTANCES LIST
All components on list

SECTION 16 OTHER INFORMATION

None known at this time.

MANUFACTURER DISCLAIMER

This material data sheet conforms to the requirements of ANSI Z400.1. The foregoing data has been compiled from sources, which the company, in good faith, believes to be dependable and is accurate and reliable to the best of our knowledge and belief. However, the company cannot make any warranty or representation respecting accuracy or completeness of the data and assumes no responsibility for any liability or damages relating thereto or for advising you regarding the protection of your employees, customers, or others. Users should consult OSHA and other applicable safety laws and regulations before use.

Contact Name: George Hiduk
313-366-9300

Issued: October 8, 2004

MATERIAL SAFETY DATA SHEET

SECTION 1 CHEMICAL PRODUCT and COMPANY IDENTIFICATION

Product Name: Alphathane NB 1142B Pt 2

For Chemical Emergency, Spill, Leak, Fire, Exposure, or Accident, call **CHEMTREC** – Day or Night
800-424-9300

Manufacturer and Supplier Information
Alpha Resins, Inc.
17350 Ryan Road
Detroit, MI 48212
313-366-9300

SECTION 2 COMPOSITION / INFORMATION on INGREDIENTS

Component	CAS Number	Range % by Weight
Polymeric diphenylmethane diisocyanate	9016-87-9	30 - 50
Methylene bis(phenylisocyanate) (MDI)	101-68-8	10 - 30
Isocyanic Acid, Methylenediphenylene Ester	26447-40-5	1 - 10
Aromatic Petroleum Distillate	64742-95-6	20 - 40
1, 2, 4, Trimethylbenzene	95-63-6	3 - 17
Kerosene	8008-20-6	2 - 10

SECTION 3 HAZARDS IDENTIFICATION

EMERGENCY OVERVIEW: Harmful by inhalation, in contact with skin and if swallowed. Irritating to eyes and skin. Prompt medical attention is required in case of eye contact.

POTENTIAL HEALTH EFFECTS

EYE CONTACT: May cause eye irritation, redness, pain, blurred vision, inflammation or corneal opacity.

SKIN CONTACT: Frequent or prolonged contact may cause redness, itching, or burning, stinging, defatting of skin and dermatitis. Skin contact may result in allergic skin reactions or respiratory sensitization, but is not expected to result in absorption of amounts sufficient to cause other adverse effects.

INHALATION: May cause respiratory tract irritation, headache, nausea and dizziness. May cause respiratory sensitization in susceptible individuals.

INGESTION: May cause irritation of the mouth and stomach and central nervous system, vomiting and diarrhea. Aspiration of the material into lungs can cause chemical pneumonitis, which can be fatal.

H-1 F-2 R-1

MATERIAL SAFETY DATA SHEET

SECTION 1 CHEMICAL PRODUCT and COMPANY IDENTIFICATION

Product Name: Alphathane NB 1043A Pt I

Manufacturer and Supplier Information
Alpha Resins, Inc.
17350 Ryan Road
Detroit, MI 48212
313-366-9300

For Chemical Emergency, Spill, Leak, Fire, Exposure, or Accident, call **CHEMTREC** – Day or Night
800-424-9300

SECTION 2 COMPOSITION / INFORMATION on INGREDIENTS

Component	CAS Number	Range % by Weight
Phenolic Resin	9003-35-4	50 - 55
Phenol	108-95-2	<6.5
Aromatic Petroleum Distillate	64742-94-5	10 - 20
Aromatic Petroleum Distillate	64742-95-6	10 - 20
Naphthalene	91-20-3	1 - 3
1,2,4-Trimethylbenzene	95-63-6	1 - 5
Ester solvents	1119-40-0 & 627-93-0 & 106-65-0	10 - 15

SECTION 3 HAZARDS IDENTIFICATION

EMERGENCY OVERVIEW: Harmful by inhalation, in contact with skin and if swallowed. Irritating to eyes and skin.

POTENTIAL HEALTH EFFECTS

EYE CONTACT: May cause eye irritation, redness, pain, inflammation, blurred vision or corneal opacity. Concentrations of 10 ppm in humans can be tolerated without significant eye irritation.

SKIN CONTACT: Frequent or prolonged contact may cause moderate irritation, stinging, defatting of skin and dermatitis.

INHALATION: May cause respiratory tract irritation, headache, nausea and dizziness.

INGESTION: May cause irritation of the mouth and stomach and central nervous system, vomiting and diarrhea. Aspiration of the material into lungs can cause chemical pneumonitis which can be fatal.

MATERIAL SAFETY DATA SHEET

SECTION 1 CHEMICAL PRODUCT and COMPANY IDENTIFICATION

Product Name: Alphathane NB 1205 Pt 3

Manufacturer and Supplier Information
Alpha Resins, Inc.
17350 Ryan Road
Detroit, MI 48212
313-366-9300

For Chemical Emergency, Spill, Leak, Fire, Exposure, or Accident, call **CHEMTREC** – Day or Night
800-424-9300

SECTION 2 COMPOSITION / INFORMATION on INGREDIENTS

Component	CAS Number	Range % by Weight
Aromatic Petroleum Distillate	64742-94-5	65 - 85
contains Naphthalene	91-20-3	2 - 9
4-Phenyl Propyl Pyridine	2057-49-0	15 - 25

SECTION 3 HAZARDS IDENTIFICATION

EMERGENCY OVERVIEW: Harmful by inhalation, in contact with skin and if swallowed. Slightly irritating to eyes and skin.

POTENTIAL HEALTH EFFECTS

EYE CONTACT: May cause eye irritation, redness, pain, inflammation, blurred vision or corneal opacity.

SKIN CONTACT: Frequent or prolonged contact may cause moderate irritation, stinging, defatting of skin and dermatitis.

INHALATION: May cause respiratory tract irritation, headache, nausea and dizziness.

INGESTION: May cause irritation of the mouth and stomach and central nervous system, vomiting and diarrhea. Aspiration of the material into lungs can cause chemical pneumonitis which can be fatal.

HMIS RATING

HEALTH	=	2
FLAMMABILITY	=	2
REACTIVITY	=	0

NFPA CODE

HEALTH	=	2
FLAMMABILITY	=	2
REACTIVITY	=	0

H-1 F-0 R-0

MATERIAL SAFETY DATA SHEET

ATOTECH USA INC.
1750 OVERVIEW DRIVE
ROCK HILL, S.C. 29730

EMERGENCY TELEPHONE NUMBER
8:00 am - 5:00 pm
(803) 817-3500

CHEMTREC - 24 HOURS
1-800-424-9300

NAME USED ON LABEL: POTASSIUM FLUOBORATE SPEC 104
CHEMICAL NAME (if single substance): Potassium Fluoroborate
CHEMICAL FAMILY: Inorganic Fluoroborate
FORMULA: KBF4

****
HAZARDOUS INGREDIENTS
****

IDENTITY	CAS No.	%	EXPOSURE LIMITS
Potassium Fluoroborate	14075-53-7	100	ACGIH-TWA(1): 2.5 mg/m3 OSHA-PEL(1): 2.5 mg/m3

(1) Fluorides, as F.

****
PHYSICAL DATA
****

BOILING POINT: N/APP
SPECIFIC GRAVITY: ~2.5 g/cm3
VAPOR DENSITY (Air=1): N/A
% VOLATILE: N/A
pH: 6-8 (aq. soln)

MELTING POINT: ~986 deg F
VAPOR PRESSURE @ 20 C: N/APP
SOLUBILITY IN WATER: Complete
EVAPORATION RATE (Butyl Acetate=1): N/APP

APPEARANCE: White, free-flowing solid. Odorless.

****
FIRE AND EXPLOSION DATA
****

FLASH POINT (Test Method)	AUTOIGNITION TEMPERATURE	FLAMMABLE LTS.
N/APP	N/A	LEL-N/A UEL-N/A

EXTINGUISHING MEDIA: Noncombustible- Use extinguishing media appropriate to surrounding fire conditions.

SPECIAL FIRE FIGHTING PROCEDURES: Do not get material on skin or clothing. Avoid inhalation of fumes or mists. Stay upwind, out of low areas, and ventilate closed spaces before entering. Cool containers from the side with water until fire is out. Use water spray to reduce vapor; do not put water directly on leak or spill area. Keep combustibles away from spilled material. Self-contained breathing apparatus (SCBA) and chemical-protective clothing can be worn but may not provide adequate thermal protection for chemical

*N/A = NOT AVAILABLE
**N/APP = NOT APPLICABLE
***N/E = NOT ESTABLISHED

HZ F-1 R-0

MATERIAL SAFETY DATA SHEET

RHONE-POULENC BASIC CHEMICALS CO.
1 Corporate Drive Box 881 Shelton, Conn 06484
24-HOUR EMERGENCY TELEPHONE CHEMTREC 1-800-424-9300

Effective Date: MAR 8, 1991 Date Printed: MAR 8, 1991
Supercedes: JAN 15, 1991

PRODUCT NAME: SULFUR

I. IDENTIFICATION A

CHEMICAL NAME OF PRIMARY COMPONENT(S): Sulfur

FORMULA: Sx ATOMIC WEIGHT: 32.06

SYNONYMS: brimstone, flowers of sulphur, ground sulfur, industrial sulfur

TRADENAMES: ANCHOR(R), YELLOTONE(R), DIAMOND-S(R), TRIANGLE(R), Crude Lump, ARROW(R) Roll, TIRE(R), Rubbermakers, Screened Crude, Spider, LACCO(R)

CAS # & NAME: 7704-34-9 Sulfur

II. INGREDIENTS/SUMMARY OF HAZARDS

REDIENT(S)	CAS Number	OSHA Hazardous (H)/ Non-Hazardous (NH)	Percent
(1) sulfur	7704-34-9	H	97-100

WARNING STATEMENTS:

WARNING! BURNING SULFUR EMITS HIGHLY TOXIC FUMES.
SULFUR DUST SUSPENDED IN AIR IGNITES EASILY.
SULFUR DUST CAUSES EYE IRRITATION.

Avoid contact with eyes. Keep away from heat, sparks and flames. Avoid creating dust in handling. Wash thoroughly after handling. Keep container closed. Use with adequate ventilation. Keep from contact with oxidizing materials.

See Section VI for complete Health Hazard Data.

NATIONAL FIRE PROTECTION ASSOCIATION RATING

ZARDOUS MATERIALS IDENTIFICATION SYSTEM

KEY = NFPA/HMIS	NFPA	HMIS
4=Extreme/ Severe	Health	
3=High/ Serious	2	1
2=Moderate	Fire	
	1	1
1=Slight	Reactivity	
0=Minimum	0	0

(continued on Page 2)

WEDRON

SILICA

Material Safety Data Sheet

Date: February 15, 2006 **Supersedes:** June 29, 2005

SECTION 1: PRODUCT IDENTIFICATION

Trade Name as Labeled: Silica, Lake or Bank Sand; All Grades
Chemical Name and Formula: Silica, mainly in the form of quartz (crystalline silica); SiO_2

Manufacturer:
Wedron Silica Company
P.O. Box 177
Wedron, IL 60557
Phone: (815) 433-2449

Emergency Telephone Number: (800) 281-9876

"This Wedron Silica Company product is not intended for and is strictly prohibited for sandblasting."

SECTION 2: COMPOSITION/INFORMATION ON INGREDIENTS

Chemical	CAS Number	% by Weight
Crystalline Silica (Quartz)	14808-60-7	87-99.9

Crystalline silica exists in several forms, the most common of which is quartz. If crystalline silica (quartz) is heated to more than 870°C, it can change to a form of crystalline silica known as trydimite, and if crystalline silica (quartz) is heated to more than 1470°C, it can change to a form of crystalline silica known as cristobalite. The OSHA PEL for crystalline silica as trydimite and cristobalite is one-half of the OSHA PEL for crystalline silica (quartz).

SECTION 3: HAZARD IDENTIFICATION

Emergency Overview: The material is white or tan colored free-flowing sand. High airborne levels of dust may cause irritation to eyes and upper respiratory tract. Crystalline silica is an IARC Group 1 carcinogen. Contact with powerful oxidizing agents such as fluorine, chlorine trifluoride, manganese trioxide, oxygen difluoride, may cause fire. It dissolves in hydrofluoric acid and may produce a corrosive gas (silicon tetrafluoride).

Acute Health Effects:

Inhalation: Excessive exposure to high concentrations of dust may cause irritation to the eyes, skin, and mucous membranes of the upper respiratory tract.

Eye: Dusts may cause irritation to the eye. Scratching of cornea can occur if eye is rubbed.

Ingestion: Ingestion of harmful amounts of this product as distributed is unlikely due to its solid insoluble form. Ingestion of excessive amounts of dust may cause nausea or vomiting.

Chronic Health Effects:

Chronic inhalation of respirable crystalline silica may cause silicosis; a fibrosis (scarring) of the lungs. Silicosis may be progressive; it may lead to disability and death. Crystalline silica inhaled from occupational sources is classified as carcinogenic to humans. There is some evidence that inhalation of respirable crystalline silica or silicosis is associated with an increased incidence of scleroderma (an immune system disorder manifested by fibrosis of the lungs, skin, and other internal organs), and kidney disease. Silicosis is also reported to increase the

Green Sand Information

Green Sand Mix Quantities per 1500-Pound Batch

Component	Quantity
Bondtone (organophilic clay)	5 lb
Potassium fluoroborate (KBF4)	4 lb
Sunpar Oil	3 quarts
Sulfur	1.5 lb
Sand	3 shots (about 1500 lb)

H-0 F-1 R-0

MATERIAL SAFETY DATA SHEET

1. CHEMICAL PRODUCT AND COMPANY INFORMATION

Product Name: **SUNPAR 150**

Manufacturer Information:

Sunoco, Inc. (R&M)
Ten Penn Center
1801 Market Street
Philadelphia, Pennsylvania, 19103-1699

Product Use:

Process Oil

Emergency Phone Numbers:

Chemtrec (800) 424-9300
Sunoco Inc. (800) 964-8861

Information:

Product Safety Information (610) 859-1120

2. COMPOSITION/INFORMATION ON INGREDIENTS

Component	CAS No.	Amount (Vol%)
SEVERELY SOLVENT REFINED HEAVY PARAFFINIC PETROLEUM OIL	64741-88-4	100 - 100

EXPOSURE GUIDELINES (SEE SECTION 15 FOR ADDITIONAL EXPOSURE LIMITS)

	CAS No.	Governing Body	Exposure Limits

3. HAZARDS IDENTIFICATION

- **EMERGENCY OVERVIEW**
  Poses little or no immediate hazard.

  Hazards Ratings:
  Key: 0 = least, 1 = slight, 2 = moderate, 3 = high, 4 = extreme

	Health	Fire	Reactivity	PPI
NFPA	0	1	0	
HMIS	0	1	0	X

- **POTENTIAL HEALTH EFFECTS**
  - **PRE-EXISTING MEDICAL CONDITIONS**
    The following diseases or disorders may be aggravated by exposure to this product: Skin;

Sand Analytical Data

Dry Sand

TestAmerica
ANALYTICAL TESTING CORPORATION 704 ENTERPRISE DRIVE · CEDAR FALLS, IA 50613 · 319-277-2401 · 800-750-2401 · FAX 319-277-2425

ANALYTICAL REPORT

Joe Haller
FANSTEEL/WELLMAN CORP.
1746 Commerce Road
Creston, IA 50801

04/19/2005

TestAmerica Job: 05.04368

Project Number:
Project: Sand-TCLP

Enclosed is the Analytical Reports for the following samples submitted to the Cedar Falls Division of TestAmerica Analytical Testing Corporation for analysis.

Sample Number	Sample Description	Date Taken	Date Received
859879	3-29-05 Sand	03/29/2005	03/30/2005

TestAmerica Analytical Testing Corporation certifies that the analytical results contained herein apply only to the specific samples analyzed.

Reproduction of this analytical report is permitted only in its entirety.

Linda Cmelik

Linda Cmelik
Project Coordinator

TestAmerica
ANALYTICAL TESTING CORPORATION 704 ENTERPRISE DRIVE · CEDAR FALLS, IA 50613 · 319-277-2401 · 800-750-2401 · FAX 319-277-2425

ANALYTICAL REPORT

Joe Haller
FANSTEEL/WELLMAN CORP.
1746 Commerce Road
Creston, IA 50801

04/19/2005

Date Received: 03/30/2005
Job Number: 05.04368

	Result	Units	Flags	Date Taken	Date Analyzed	Regulatory Limit	Analyst	Analysis Method
859879 3-29-05 Sand								
Solid pH Measured in Water	6.6	units		03/29/2005	04/12/2005	<2.0 & >12.5	sas	SW 9045
TCLP Metals Digest	Complete			03/29/2005	04/14/2005		heh	
TCLP - Mercury	<0.0020	mg/L		03/29/2005	04/19/2005	0.2	heh	SW 7470
ICP TCLP METALS				03/29/2005				
TCLP Arsenic (ICP)	<0.300	mg/L		03/29/2005	04/14/2005	5.0	heh	SW 6010B
TCLP Barium (ICP)	<0.100	mg/L		03/29/2005	04/14/2005	100	heh	SW 6010B
TCLP Cadmium (ICP)	<0.020	mg/L		03/29/2005	04/14/2005	1.0	heh	SW 6010B
TCLP Chromium (ICP)	<0.020	mg/L		03/29/2005	04/14/2005	5.0	heh	SW 6010B
TCLP Lead (ICP)	<0.10	mg/L		03/29/2005	04/14/2005	5.0	heh	SW 6010B
TCLP Selenium (ICP)	<0.15	mg/L		03/29/2005	04/14/2005	1.0	heh	SW 6010B
TCLP Silver (ICP)	<0.020	mg/L		03/29/2005	04/14/2005	5.0	heh	SW 6010B
TCLP EXTRACTION	complete			03/29/2005	04/12/2005		kak	SW 1311

Key to Flags:

TestAmerica
ANALYTICAL TESTING CORPORATION 704 ENTERPRISE DRIVE · CEDAR FALLS, IA 50613 · 319-277-2401 · 800-750-2401 · FAX 319-277-2425

TestAmerica Job Number: 05.04368

ATTACHMENTS

Following are the sample receipt log and the chain of custody applicable to this analytical report.

Any abnormalities or departures from sample acceptance policy shall be documented on the "Sample Receipt and Temperature Log Form" and Sample Non-Conformance Form" (if applicable) included with this report.

For information concerning certifications of this facility or another TestAmerica facility please visit our website at **www.TestAmericaInc.com.**

This data has been produced in compliance with 2002 NELAC Standards (July 2004), except where noted.

Samples collected by TestAmerica Field Services personnel are noted on the Chain of Custody (COC) and are sampled in accordance with TA-CF SOP CF09-01.

This report shall not be reproduced, except in full, without written approval of the laboratory.

For questions regarding this report, please contact the individual who signed the analytical report.

Fansteel
Wellman Dynamics
1746 Commerce Road, Creston, Iowa 50801
(641) 782-8521 FAX: (641) 782-7672

To:	Kristin Clay (Test America)	From:	Joe Haller
Fax:	319-277-2425	Pages:	1 (Including cover sheet)
Phone:	319-277-2401	Date:	4/11/2005
Re:	Additional laboratory analysis	CC:	None

Kristin,

As discussed on the phone today I would like additional analysis to be completed on the reclaim foundry sand that was submitted for Test America Job: 05.03748

The analysis that I would like to have done on this sand is a TCLP of the 8 RCRA metals of arsenic, mercury, barium, cadmium, chromium, lead, selenium, and silver. If you have any questions with regard to this fax please feel free to contact me at 641-782-8521 ext 206.

Sincerely,

Joe Haller

Joe Haller
Wellman Dynamics Corporation
641-782-8521 ext. 206

TestAmerica

INCORPORATED

Cedar Falls Division
704 Enterprise Dr, Cedar Falls, IA 50613-0625
Phone: (319) 277-2401 Fax: (319) 277-2425

TO: Joe Haller

COMPANY: FANSTEEL/WELLMAN CORP.

Fax: jhaller@weldyn.net

FROM: Kristin Clay

PHONE: (319)277-2401

SENT ON: 04/07/05 04:43 PM CDT

PAGES INCLUDING COVER: 4

COMMENTS:

PLEASE CALL NUMBER ABOVE IF FAX TRANSMISSION IS INCOMPLETE

Dry Sand

ANALYTICAL REPORT

Joe Haller
FANSTEEL/WELLMAN CORP.
1746 Commerce Road
Creston, IA 50801

04/07/2005

TestAmerica Job: 05.03748

Project Number:
Project: Metals-Alternate Soil Usage Chpt 13

Enclosed is the Analytical Reports for the following samples submitted to the Cedar Falls Division of TestAmerica Analytical Testing Corporation for analysis.

Sample Number	Sample Description	Date Taken	Date Received
857790	3-29-05 Sand	03/29/2005	03/30/2005

TestAmerica Analytical Testing Corporation certifies that the analytical results contained herein apply only to the specific samples analyzed.

H-1 F-1 R-0

CUMMINGS-MOORE GRAPHITE CO.
MATERIAL SAFETY DATA SHEET

Hazard Communication Standard
29 CFR 1910, 1200.

TYPE: Natural Graphite, Less that 85 Carbon

(General)

IDENTITY: Natural Graphite Graphite

Note: Blank spaces are not permitted. If any item is not applicable, or no information is available, the space must be marked to indicate that.

SECTION I

Manufacturer's Name: Cummings-Moore Graphite Co.
1646 N. Green Ave
Detroit, MI 48209

Emergency Telephone Number 908-537-2155
Telephone Number for Information 908-537-2155
Date: January 2003 Review Date: 1/2004
Prepared by: (optional) AVT

SECTION II -HAZARDOUS INGREDIENTS/IDENTITY INFORMATION

Component(s) (Specific Chemical Identity, Common Name(s)		OSHA PEL	Other Limits ACGIH TLV	Recommended	% (optional)
Graphite	CAS NO. 7782-42-5	2.0 mg/m3		Respirable dust.	100
Silica	CAS NO. 14808-60-7	0.05 mg/m3		Respirable dust	0.0-4.0

TSCA Status: Graphite is listed on the US EPA TSCA inventory

SECTION III - PHYSICAL CHEMICAL CHARACTERISTICS

Boiling Point: N/A

Specific Gravity (H2O = 1): 2.20 - 2.35

Vapor Pressure (mm Hg.): N/A

Melting Point: N/A

Vapor Density (AIR = 1): N/A

Evaporation Rate: (Butyl Acetate = 1) N/A

Solubility in Water: Insoluble

Appearance and Odor: Grey to Black - No Odor

SECTION IV - FIRE AND EXPLOSION HAZARD DATA

Flash Point (Method Used): N/A Flammable Limits: N/A LEL: N/A UEL: N/A

Extinguishing Media: Water

Special Fire Fighting Procedures: Spray with water.

Unusual Fire and Explosion Hazards: None.

HMIS RATING 1 1 0 R NFP RATING: 0 1 0

ANALYTICAL REPORT

Joe Haller
FANSTEEL/WELLMAN CORP.
1746 Commerce Road
Creston, IA 50801

04/07/2005

METALS-ALTERNATE SOIL USAGE CHPT 13

Date Received: 03/30/2005
Job Number: 05.03748

	Result	Units	Flags	Date Taken	Date Analyzed	Time Analyzed	Analyst	Analysis Method
857790 3-29-05 Sand								
Solids, Total	99.89	%		03/29/2005	03/30/2005		sas	SM 2540 G
Arsenic, (GFAA)	<1.0	mg/kg dw		03/29/2005	04/04/2005		krb	SW 7060A
Beryllium, (GFAA)	<0.50	mg/kg dw		03/29/2005	04/05/2005		heh	SW 7091
Mercury, Cold Vapor	<0.020	mg/kg dw		03/29/2005	04/05/2005		heh	SW 7471A
Thallium, (GFAA)	<1.0	mg/kg dw		03/29/2005	04/06/2005		krb	SW 7841
GFAA Metals Digestion	1.029	g		03/29/2005	04/04/2005		heh	SW 3050 B
ICP Metals Prep (Solid)	1.042	g		03/29/2005	03/31/2005		llw	SW 3050 B
ICP Metals-Solid				03/29/2005				
Antimony, (ICP)	<5.0	mg/kg dw		03/29/2005	04/01/2005		llw	SW 6010B
Barium, (ICP)	3.7	mg/kg dw		03/29/2005	04/01/2005		llw	SW 6010B
Boron, (ICP)	110	mg/kg dw		03/29/2005	04/01/2005		llw	SW 6010B
Cadmium, (ICP)	<1.0	mg/kg dw		03/29/2005	04/01/2005		llw	SW 6010B
Chromium, (ICP)	10	mg/kg dw		03/29/2005	04/01/2005		llw	SW 6010B
Copper, (ICP)	15	mg/kg dw		03/29/2005	04/01/2005		llw	SW 6010B
Lead, (ICP)	<5.0	mg/kg dw		03/29/2005	04/01/2005		llw	SW 6010B
Manganese, (ICP)	92	mg/kg dw		03/29/2005	04/01/2005		llw	SW 6010B
Molybdenum, (ICP)	3.1	mg/kg dw		03/29/2005	04/01/2005		llw	SW 6010B
Nickel, (ICP)	5.9	mg/kg dw		03/29/2005	04/01/2005		llw	SW 6010B
Selenium, (ICP)	<7.5	mg/kg dw		03/29/2005	04/01/2005		llw	SW 6010B
Silver, (ICP)	<1.0	mg/kg dw		03/29/2005	04/01/2005		llw	SW 6010B
Vanadium, (ICP)	<2.5	mg/kg dw		03/29/2005	04/01/2005		llw	SW 6010B
Zinc, (ICP)	14	mg/kg dw		03/29/2005	04/01/2005		llw	SW 6010B

Key to Flags:

TestAmerica Job Number: 05.03748

ATTACHMENTS

Following are the sample receipt log and the chain of custody applicable to this analytical report.

Any abnormalities or departures from sample acceptance policy shall be documented on the "Sample Receipt and Temperature Log Form" and Sample Non-Conformance Form" (if applicable) included with this report.

For information concerning certifications of this facility or another TestAmerica facility please visit our website at **www.TestAmericaInc.com**.

This data has been produced in compliance with 2002 NELAC Standards (July 2004), except where noted.

Samples collected by TestAmerica Field Services personnel are noted on the Chain of Custody (COC) and are sampled in accordance with TA-CF SOP CF09-01.

This report shall not be reproduced, except in full, without written approval of the laboratory.

For questions regarding this report, please contact the individual who signed the analytical report.

Leachate Analytical Data

Hygienic Laboratory

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Report Results To	
H R GREEN CO	Sample Identification: 9260819
250 GLASS RD N.E. BOX 9009	Submitter Reference: S-3
CEDAR RAPIDS, IA 52409	Location: CRESTON
	Sample Type: WATER
	Date Collected: 07/16/92 10:40:00
Date Received: 07/17/92	Collected by: GAVIN RANDALL
Date Reported: 08/20/92	

Comments
BILL TO: WELLMAN DYNAMICS-CRESTON
THIS SAMPLE GOES WITH UHL#9207337

— Results of Analyses —

Description: INORGANIC CHEMISTRY

Analyte	Concentration	Method	Analyst/Verifier	Date Analyzed
TOTAL SOLIDS	7200 MG/L @103 C	EPA 160.3	MS/LF	07/27/92
DISSOLVED SOLIDS	4000 MG/L @180 C	EPA 160.1	MS/LF	07/27/92
SUSPENDED SOLIDS	2400 MG/L @103 C	EPA 160.2	MS/LF	07/24/92
CHLORIDE	340 MG/L	EPA 325.3	SMM/LF	07/17/92
FLUORIDE	120 MG/L	TIM 380-75W	BR/LF	08/06/92
SULFATE	1100 MG/L	EPA 375.4	LDA/LF	07/21/92
BROMIDE	1.8 MG/L	EPA 300.0	RVD/LF	08/03/92
Comments	*Due to chloride interference, bromide was analyzed on a diluted portion of the original sample.*			
SULFITE	<1 MG/L	EPA 377.1	RS/LF	07/17/92
SULFIDE	0.2 MG/L	SM 427	LDA/LF	07/27/92
AMMONIA (AS N)	25 MG/L	TIM #780-86	RW/LF	07/29/92
NO2+NO3 AS NO3-N	<0.1 MG/L	EPA 353.2	BR/LF	06/22/92
TOTAL PHOSPHORUS (P)	35 MG/L	TIM #787-86	RW/LF	08/04/92
5 DAY BOD	80 MG/L	SM 16-507	RO/LF	07/28/92
Comments	*BOD MISSED AND RESET. VALUE MAY BE LOW.*			
CHEMICAL OXYGEN DMND	270 MG/L	EPA 410.1	BR/LF	08/05/92
TOTAL CYANIDE	<0.01 MG/L	EPA 335.2	LDA/LF	07/27/92
PHENOLS (4AAP REAC.)	140 uG/L	EPA 420.2	BR/LF	07/29/92
TOTAL ALUMINUM	43 MG/L	EPA 200.7	RVD/LF	07/27/92
TOTAL ANTIMONY	<0.01 MG/L	EPA 204.2	DC/LF	07/29/92
TOTAL ARSENIC	<0.01 MG/L	EPA 206.2	ML/LF	07/27/92
TOTAL BARIUM	0.95 MG/L	EPA 200.7	RVD/LF	08/05/92

Parts/Million ... MG/L Milligrams/Liter ... MG/KG Milligrams/Kilogram
Parts/Billion ... UG/L Micrograms/Liter ... UG/KG Micrograms/Kilogram

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Page No. 2
UHL Sample No. 9260819

Description: INORGANIC CHEMISTRY

Analyte	Concentration	Method	Analyst/Verifier	Date Analyzed
TOTAL BERYLLIUM	<0.02 MG/L	EPA 200.7	RVD/LF	08/05/92
TOTAL BORON	260 MG/L	EPA 200.7	RVD/LF	07/29/92
TOTAL CADMIUM	<0.02 MG/L	EPA 200.7	RVD/LF	07/27/92
TOTAL CHROMIUM	0.11 MG/L	EPA 218.1	SMM/LF	07/24/92
CHROMIUM, HEXAVALENT	<0.05 MG/L	SM 14ED 307	RS /LF	06/17/92
TOTAL COBALT	<0.05 MG/L	EPA 200.7	RVD/LF	07/28/92
TOTAL COPPER	<0.05 MG/L	EPA 220.1	SMM/LF	07/27/92
TOTAL IRON	120 MG/L	EPA 200.7	RVD/LF	07/23/92
TOTAL LEAD	<0.1 MG/L	EPA 200.7	RVD/LF	07/24/92
TOTAL MAGNESIUM	300 MG/L	EPA 200.7	RVD/LF	07/23/92
TOTAL MANGANESE	6.0 MG/L	EPA 200.7	RVD/LF	07/23/92
TOTAL MERCURY	<0.001 MG/L	EPA 245.1	DC /LF	07/23/92
TOTAL NICKEL	0.14 MG/L	EPA 200.7	RVD/LF	07/27/92
TOTAL SELENIUM	<0.01 MG/L	EPA 270.2	ML /LF	07/27/92
TOTAL SILVER	0.01 MG/L	EPA 272.1	ML /LF	07/28/92
TOTAL THALLIUM	<0.001 MG/L	EPA 279.2	DC /LF	07/29/92
TOTAL TIN	<0.5 MG/L	EPA 200.7	RVD/LF	07/29/92
TOTAL ZINC	0.97 MG/L	EPA 289.1	SMM/LF	07/26/92

Description: GC/MS EXTRACTABLES

Analyte	Concentration ug/L	Quantitation Limit
PHENOL	<4	4
BIS(2-CHLOROETHYL) ETHER	<4	4
2-CHLOROPHENOL	<4	4
1,3-DICHLOROBENZENE	<4	4
1,4-DICHLOROBENZENE	<4	4
BENZYL ALCOHOL	<10	10
1,2-DICHLOROBENZENE	<4	4
2-METHYLPHENOL	<10	10
BIS(2-CHLOROISOPROPYL) ETHER	<4	4
4-METHYLPHENOL	<10	10
N-NITROSO-DI-N-PROPYLAMINE	<6	6
HEXACHLOROETHANE	<6	6
NITROBENZENE	<6	6
ISOPHORONE	<4	4
2-NITROPHENOL	<8	8
2,4-DIMETHYLPHENOL	<6	6

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alyte	Concentration ug/L	Quantitation Limit
BIS(2-CHLOROETHOXY) METHANE	<4	4
,4-DICHLOROPHENOL	<6	6
,4-TRICHLOROBENZENE	<4	4
PHTHALENE	<4	4
CHLOROANILINE	<8	8
EXACHLOROBUTADIENE	<6	6
HLORO-3-METHYLPHENOL	<6	6
METHYLNAPHTHALENE	<4	4
EXACHLOROCYCLOPENTADIENE	<10	10
6-TRICHLOROPHENOL	<6	6
5-TRICHLOROPHENOL	<8	8
CHLORONAPHTHALENE	<4	4
ITROANILINE	<8	8
METHYL PHTHALATE	<4	4
CENAPHTHYLENE	<4	4
NITROANILINE	<20	20
ENAPHTHENE	<4	4
DINITROPHENOL	<30	30
NITROPHENOL	<30	30
ENZOFURAN	<4	4
DINITROTOLUENE	<8	8
-DINITROTOLUENE	<6	6
THYL PHTHALATE	<6	6
HLOROPHENYL PHENYL ETHER	<6	6
UORENE	<4	4
ITROANILINE	<30	30
DINITRO-2-METHYLPHENOL	<20	20
ITROSODIPHENYLAMINE	<6	6
BROMOPHENYL PHENYL ETHER	<6	6
ACHLOROBENZENE	<6	6
TACHLOROPHENOL	<20	20
ENANTHRENE	<4	4
THRACENE	<4	4
-BUTYL PHTHALATE	<6	6
ORANTHENE	<8	8
RENE	<8	8
YL BENZYL PHTHALATE	<6	6
DICHLOROBENZIDINE	<10	10
NZO(A)ANTHRACENE	<4	4

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...alyte	Concentration ug/L	Quantitation Limit
...S(2-ETHYLHEXYL) PHTHALATE	<10	10
...HRYSENE	<4	4
...-N-OCTYL PHTHALATE	<10	10
...ENZO(B)FLUORANTHENE	<8	8
...ENZO(K)FLUORANTHENE	<8	8
...ENZO(A)PYRENE	<4	4
...DENO(1,2,3-CD)PYRENE	<6	6
...BENZ(A,H)ANTHRACENE	<6	6
...ENZO(G,H,I)PERYLENE	<6	6
...NITROSODIMETHYLAMINE	<10	10
...ENZIDINE	<10	10

...te Analyzed: 07/30/92 — Analyst: KH

...thod: EPA 625 — Verified: TC

Description: RADIOCHEMISTRY

...alyte	Conc.	Units	Prec.	Quant. Limit	Method	Analyst / Verifier	Date Analyzed
...ROSS ALPHA	2.0	pCi/L	1.0	0.8	EPA 900.0	DR /MM	07/22/92
...ROSS BETA	874.9	pCi/L	33.0	3.3	EPA 900.0	DR /MM	07/22/92
...ADIUM-226	1.0	pCi/L	0.1	0.1	EPA 904.0	DCK/MM	08/13/92
...ADIUM-228	<0.8	pCi/L		0.8	EPA 904.0	DCK/MM	08/13/92
...OTAL RADIUMS	<1.8	pCi/L			EPA 904.0	DCK/MM	08/13/92

Description: ANALYSIS FOR ACID HERBICIDES IN WATER

...nalyte	Concentration uG/L	Quantitation Limit
...-D	<0.2	0.2
...LVEX	<0.2	0.2

...te Analyzed: 07/24/92 — Analyst: WP

...thod: EPANPS3 — Verified: DL

Description: ANALYSIS FOR MISCELLANEOUS WATER SAMPLES

...alyte	Concentration uG/L	Quantitation Limit
...DRIN	<0.5	0.5
...pha-BHC	<0.5	0.5
...ta-BHC	<0.5	0.5
...lta-BHC	<0.5	0.5
...mma-BHC (LINDANE)	<0.5	0.5

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UHL Sample No: 9260819

alyte	Concentration uG/L	Quantitation Limit
LORDANE	<2	2
-DDD	<0.5	0.5
-DDE	<0.5	0.5
-DDT	<0.5	0.5
ELDRIN (HEOD)	<0.5	0.5
DOSULFAN I	<0.5	0.5
DOSULFAN II	<0.5	0.5
DOSULFAN SULFATE	<0.5	0.5
DRIN (ENDREX)	<0.5	0.5
DRIN ALDEHYDE	<0.5	0.5
PTACHLOR	<0.5	0.5
PTACHLOR EPOXIDE	<0.5	0.5
THOXYCHLOR	<0.5	0.5
XAPHENE	<10	10
B-1016	<5	5
3-1221	<5	5
3-1232	<5	5
B-1242	<5	5
3-1248	<5	5
3-1254	<5	5
3-1260	<5	5

e Analyzed: 07/24/92
hod: 508\8080

Analyst: VR
Verified: DL

rdinator of analytical services - Lynn Hudachek @ (319) 335-4500

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Report Results To	
H R GREEN CO 4250 GLASS RD N.E. BOX 9009 CEDAR RAPIDS, IA 52409	Sample Identification: 9207337 Submitter Reference: S-3 Location: WELLMAN DYNAMICS Sample Type: WATER
Date Received: 07/17/92	Date Collected: 07/16/92 10:40:00
Date Reported: 08/04/92	Collected by: GAVIN RANDALL T

Comments:
THIS SAMPLE GOES WITH DML SAMPLE #9260819

— Results of Analyses —

Description: GC/MS VOLATILES

Analyte	Concentration ug/L	Quantitation Limit
HLOROMETHANE	<5	5
ROMOMETHANE	<5	5
VINYL CHLORIDE	<5	5
HLOROETHANE	<5	5
ETHYLENE CHLORIDE	<5	5
1.1-DICHLOROETHENE	<10	10
1-DICHLOROETHANE	<5	5
S 1,2-DICHLOROETHENE	60	5
TRANS 1,2-DICHLOROETHENE	14	5
CHLOROFORM	<5	5
2-DICHLOROETHANE	<5	5
1-TRICHLOROETHANE	<5	5
CARBON TETRACHLORIDE	54	5
ROMODICHLOROMETHANE	<5	5
CHLOROETHYLVINYL ETHER	<5	5
1,2-DICHLOROPROPANE	<10	10
TRICHLOROETHENE	<5	5
BROMOCHLOROMETHANE	<5	5
1,2-TRICHLOROETHANE	<5	5
BENZENE	<5	5
OMOFORM	<5	5
TRACHLOROETHENE	<5	5
1,1,2,2-TETRACHLOROETHANE	<5	5

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Page No. 2
UHL Sample No. 9207337

Analyte	Concentration ug/L	Quantitation Limit
TOLUENE	<5	5
CHLOROBENZENE	<5	5
ETHYLBENZENE	<5	5
ACROLEIN	<20	20
ACRYLONITRILE	<10	10
CIS-1,3-DICHLOROPROPENE	<5	5
TRANS-1,3-DICHLOROPROPENE	<5	5
ACETONE	40	10
2-HEXANONE	<10	10
2-BUTANONE	21	10
4-METHYL-2-PENTANONE	<10	10
XYLENES,TOTAL	19	5

Date Analyzed: 07/30/92
Method: EPA 624

Analyst: JN
Verified: TC

Description: GC/MS VOLATILES

Analyte	Concentration ug/L	Quantitation Limit
CHLOROMETHANE	<5	5
BROMOMETHANE	<5	5
VINYL CHLORIDE	<5	5
CHLOROETHANE	<5	5
METHYLENE CHLORIDE	<10	10
1,1-DICHLOROETHENE	<5	5
1,1-DICHLOROETHANE	58	5
CIS 1,2-DICHLOROETHENE	14	5
TRANS 1,2-DICHLOROETHENE	<5	5
CHLOROFORM	<5	5
1,2-DICHLOROETHANE	<5	5
1,1,1-TRICHLOROETHANE	54	5
CARBON TETRACHLORIDE	<5	5
BROMODICHLOROMETHANE	<5	5
2-CHLOROETHYLVINYL ETHER	<10	10
1,2-DICHLOROPROPANE	<5	5
TRICHLOROETHENE	<5	5
DIBROMOCHLOROMETHANE	<5	5
1,1,2-TRICHLOROETHANE	<5	5
BENZENE	<5	5
BROMOFORM	<5	5

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Page No: 3
UHL Sample No: 9207337

Analyte	Concentration ug/L	Quantitation Limit
ETRACHLOROETHENE	<5	5
,1,2,2-TETRACHLOROETHANE	<5	5
TOLUENE	<5	5
CHLOROBENZENE	<5	5
ETHYLBENZENE	<5	5
ACROLEIN	<20	20
ACRYLONITRILE	<10	10
IS-1,3-DICHLOROPROPENE	<5	5
RANS-1,3-DICHLOROPROPENE	<5	5
ACETONE	44	10
-HEXANONE	<10	10
-BUTANONE	20	10
-METHYL-2-PENTANONE	<10	10
YLENES,TOTAL	23	5

ate Analyzed: 07/30/92
Method: EPA 624

Analyst: JN
Verified: TC

Description: GC/MS VOLATILES

Analyte	Concentration ug/L	Quantitation Limit
HLOROMETHANE	<5	5
ROMOMETHANE	<5	5
VINYL CHLORIDE	<5	5
CHLOROETHANE	<5	5
IETHYLENE CHLORIDE	<10	10
,1-DICHLOROETHENE	<5	5
1,1-DICHLOROETHANE	61	5
IS 1,2-DICHLOROETHENE	15	5
RANS 1,2-DICHLOROETHENE	<5	5
CHLOROFORM	<5	5
2-DICHLOROETHANE	<5	5
1,1-TRICHLOROETHANE	61	5
CARBON TETRACHLORIDE	<5	5
BROMODICHLOROMETHANE	<5	5
-CHLOROETHYLVINYL ETHER	<10	10
,2-DICHLOROPROPANE	<5	5
TRICHLOROETHENE	<5	5
IBROMOCHLOROMETHANE	<5	5
,1,2-TRICHLOROETHANE	<5	5

[illegible]

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Page No. 4
UHL Sample No. 920733

Analyte	Concentration ug/L	Quantitation Limit
BENZENE	<5	5
BROMOFORM	<5	5
TETRACHLOROETHENE	<5	5
1,1,2,2-TETRACHLOROETHANE	<5	5
TOLUENE	<5	5
CHLOROBENZENE	<5	5
ETHYLBENZENE	<5	5
ACROLEIN	<20	20
ACRYLONITRILE	<10	10
CIS-1,3-DICHLOROPROPENE	<5	5
TRANS-1,3-DICHLOROPROPENE	<5	5
ACETONE	39	10
2-HEXANONE	<10	10
2-BUTANONE	18	10
4-METHYL-2-PENTANONE	<10	10
XYLENES,TOTAL	20	5

Date Analyzed: 07/30/92
Method: EPA 624

Analyst: JN
Verified: TC

Description: GC/MS VOLATILES

Analyte	Concentration ug/L	Quantitation Limit
CHLOROMETHANE	<5	5
BROMOMETHANE	<5	5
VINYL CHLORIDE	<5	5
CHLOROETHANE	<5	5
METHYLENE CHLORIDE	<10	10
1,1-DICHLOROETHENE	<5	5
1,1-DICHLOROETHANE	58	5
CIS 1,2-DICHLOROETHENE	15	5
TRANS 1,2-DICHLOROETHENE	<5	5
CHLOROFORM	<5	5
1,2-DICHLOROETHANE	<5	5
1,1,1-TRICHLOROETHANE	55	5
CARBON TETRACHLORIDE	<5	5
BROMODICHLOROMETHANE	<5	5
2-CHLOROETHYLVINYL ETHER	<10	10
1,2-DICHLOROPROPANE	<5	5
TRICHLOROETHENE	<5	5

[illegible]

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Analyte	Concentration ug/L	Quantitation Limit
BROMOCHLOROMETHANE	<5	5
,2-TRICHLOROETHANE	<5	5
ENZENE	<5	5
BROMOFORM	<5	5
TRACHLOROETHENE	<5	5
2,2-TETRACHLOROETHANE	<5	5
TOLUENE	6	5
LOROBENZENE	<5	5
HYLBENZENE	<5	5
ACROLEIN	<20	20
CRYLONITRILE	<10	10
S-1,3-DICHLOROPROPENE	<5	5
RANS-1,3-DICHLOROPROPENE	<5	5
ACETONE	45	10
HEXANONE	<10	10
UTANONE	11	10
-METHYL-2-PENTANONE	<10	10
YLENES,TOTAL	25	5

e Analyzed: 07/30/92 Analyst: JN
lethod: EPA 624 Verified: TC

Description: GC/MS VOLATILES

Analyte	Concentration ug/L	Quantitation Limit
HLOROMETHANE	<5	5
ROMOMETHANE	<5	5
/INYL CHLORIDE	<5	5
HLOROETHANE	<5	5
ETHYLENE CHLORIDE	<10	10
1-DICHLOROETHENE	<5	5
1-DICHLOROETHANE	69	5
S 1,2-DICHLOROETHENE	16	5
RANS 1,2-DICHLOROETHENE	<5	5
HLOROFORM	<5	5
-DICHLOROETHANE	<5	5
,1-TRICHLOROETHANE	37	5
ARBON TETRACHLORIDE	<5	5
ROMODICHLOROMETHANE	<5	5
CHLOROETHYLVINYL ETHER	<10	10

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alyte	Concentration ug/L	Quantitation Limit
2-DICHLOROPROPANE	<5	5
RICHLOROETHENE	<5	5
IBROMOCHLOROMETHANE	<5	5
1,2-TRICHLOROETHANE	<5	5
ENZENE	<5	5
ROMOFORM	<5	5
ETRACHLOROETHENE	<5	5
1,2,2-TETRACHLOROETHANE	<5	5
DLUENE	<5	5
HLOROBENZENE	<5	5
THYLBENZENE	<5	5
CROLEIN	<20	20
CRYLONITRILE	<10	10
S-1,3-DICHLOROPROPENE	<5	5
RANS-1,3-DICHLOROPROPENE	<5	5
CETONE	49	10
HEXANONE	<10	10
BUTANONE	23	10
METHYL-2-PENTANONE	<10	10
YLENES,TOTAL	23	5

te Analyzed: 07/30/92
ethod: EPA 624

Analyst: JN
Verified: TC

rdinator of analytical services - Lynn Hudachek @ (319) 335-4500

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Cedar Falls Division
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Cedar Falls, IA 50613
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ANALYTICAL REPORT

Gordon Crawford
FANSTEEL/WELLMAN CORP.
U.S. Route 34
P.O. Box 147
Creston, IA 50801

04/09/1996

Sample No.: 339000

NET Job No: 96.03127

Sample ID: Comp2 #715310-J02,685

CC: HELGA MAYHEW, HOWARD R. GREEN

Date Taken: 03/22/1996 Date Received: 03/23/1996

	Result	Units	Date Analyzed	Analyst	Analysis Method
Chloride	640	mg/L	03/25/1996	llw	SM 4500-Cl C
COD, Low Level	160	mg/L	03/28/1996	jcf	SM 5220 B
Fluoride, distilled	320	mg/L	04/01/1996	kmv	SM 4500-F B,C
Fluoride, dissolved	91	mg/L	04/01/1996	kmv	SM 4500-F C
Ammonia Nitrogen (probe)	28	mg/L	03/26/1996	jcf	SM 4500-NH3 F
Sulfate	860	mg/L	03/28/1996	cjh	SM 4500-SO4 E
Magnesium, Dissolved (ICP)	300	mg/L	04/03/1996	lmc	S-6010A
Sodium, Dissolved (ICP)	33	mg/L	04/03/1996	lmc	S-6010A
ICP Metals - SW-6010	Complete		03/27/1996	lmc	S-6010
Iron, ICP	320	mg/L	03/27/1996	lmc	S-6010A
Magnesium, ICP	370	mg/L	03/27/1996	lmc	S-6010A
Sodium, ICP	110	mg/L	03/27/1996	lmc	S-6010A

Units: mg/L = ppm ug/g = mg/kg = ppm

Cheryl L. Wilson
Operations Manager

NET ® NATIONAL ENVIRONMENTAL TESTING, INC.

Cedar Falls Division
704 Enterprise Drive
Cedar Falls, IA 50613
Tel: (319) 277-2401
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ANALYTICAL REPORT

Helga Mayhew
HOWARD R. GREEN CO.
4250 Glass Road NE
P.O. Box 9009
Cedar Rapids, IA 52409-9009

07/11/1996

Sample No.: 354211

NET Job No: 96.07864

Sample ID: COMP-2 #715310-J02, 0685

PROJECT: FANSTEEL-WELLMAN/CRESTON, IOWA

Date Taken: 06/19/1996 Date Received: 06/20/1996

	Result	Units	Date Analyzed	Analyst	Analysis Method
Chloride	730	mg/L	07/03/1996	llw	SM 4500-Cl C
COD, Low Level	49	mg/L	06/28/1996	kmv	SM 5220 B
Fluoride, distilled	410	mg/L	07/09/1996	cjh	SM 4500-F B,C
Fluoride, dissolved	99	mg/L	06/27/1996	cjh	SM 4500-F C
Ammonia Nitrogen (probe)	26	mg/L	07/03/1996	llw	SM 4500-NH3 F
Sulfate	1,400	mg/L	06/24/1996	cjh	SM 4500-SO4 E
Magnesium, Dissolved (ICP)	470	mg/L	07/05/1996	lmc	S-6010A
Sodium, Dissolved (ICP)	110	mg/L	07/05/1996	lmc	S-6010A
ICP Metals - SW-3010	Complete	mg/L	07/02/1996	lmc	S-3010
Iron, ICP	110	mg/L	07/02/1996	lmc	S-6010A
Magnesium, ICP	410	mg/L	07/02/1996	lmc	S-6010A
Sodium, ICP	93	mg/L	07/02/1996	lmc	S-6010A

Units: mg/L = ppm ug/g = mg/kg = ppm

Cheryl L. Wilson
Operations Manager

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TESTING, INC.

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ANALYTICAL REPORT

Helga Mayhew
HOWARD R. GREEN CO.
4250 Glass Road N.E.
Cedar Rapids, IA 52409

10/14/1996

Sample No.: 367731

NET Job No: 96.12537

Sample ID: COMP-2 Fansteel/Wellman

H.R. GREEN PROJECT #715310-J02-0685

Date Taken: 10/03/1996 Date Received: 10/04/1996

	Result	Units	Date Analyzed	Analyst	Analysis Method
Chloride	1,400	mg/L	10/05/1996	llw	SM 4500-Cl C
COD, Low Level	120	mg/L	10/12/1996	jas	SM 5220 B
Fluoride, distilled	310	mg/L	10/11/1996	cjh	SM 4500-F B,C
Fluoride, dissolved	88	mg/L	10/11/1996	cjh	SM 4500-F C
Ammonia Nitrogen (probe)	20	mg/L	10/09/1996	llw	SM 4500-NH3 F
Sulfate	1,100	mg/L	10/12/1996	cjh	SM 4500-SO4 E
ICP Metals - E 200.7	Complete	mg/L	10/10/1996	lmc	
Iron, Dissolved (ICP)	70	mg/L	10/09/1996	lmc	S-6010A
Magnesium, ICP	460	mg/L	10/10/1996	lmc	E-200.7
Magnesium, Dissolved (ICP)	520	mg/L	10/09/1996	lmc	S-6010A
Sodium, ICP	230	mg/L	10/10/1996	lmc	E-200.7
Sodium, Dissolved (ICP)	250	mg/L	10/09/1996	lmc	S-6010A

Cheryl L. Wilson
Operations Manager

Outreach Laboratory

311 North Aspen
Broken Arrow, Ok 74012
(918) 251-2515
FAX (918) 251-0008

Lab Project Number:	980922
Client:	Earth Sciences
Client Project Number:	4764A-02
Client Project Name:	Fansteel Wellman Dynamics
Date Submitted:	24-Sep-98
Date Reported:	10-Nov-98
Page:	1 of 8

		Parameter	Method	Result	Detection Limit	Units
Client Sample ID:	Leachate	**TOTAL VOLATILE ORGANICS**				
Lab Sample ID:	980922	Bromomethane	8260	BDL	10.0	ug/l
Sample Matrix:	unfilt groundwater	Chloroethane	8260	BDL	10.0	ug/l
Date Sampled:	9/23/98	Chloromethane	8260	BDL	10.0	ug/l
		Dichlorodifluoromethane	8260	BDL	10.0	ug/l
		Vinyl chloride	8260	BDL	10.0	ug/l
		1,1-Dichloroethene	8260	BDL	10.0	ug/l
		Acetone	8260	BDL	50.0	ug/l
		Methylene chloride	8260	BDL	10.0	ug/l
		trans-1,2-dichloroethene	8260	BDL	10.0	ug/l
		1,1-Dichloroethane	8260	54.1	10.0	ug/l
		cis-1,2-Dichloroethene	8260	BDL	10.0	ug/l
		2-Butanone	8260	BDL	10.0	ug/l
		Chloroform	8260	BDL	10.0	ug/l
		Bromochloromethane	8260	BDL	10.0	ug/l
		1,1,1-Trichloroethane	8260	BDL	10.0	ug/l
		Carbon tetrachloride	8260	BDL	10.0	ug/l
		1,2-Dichloroethane	8260	BDL	10.0	ug/l
		1,2-Dichloropropane	8260	BDL	10.0	ug/l
		Benzene	8260	BDL	10.0	ug/l
		Trichloroethene	8260	BDL	10.0	ug/l
		Bromodichloromethane	8260	BDL	10.0	ug/l
		4-Methyl-2-pentanone	8260	BDL	10.0	ug/l
		cis-1,3-Dichloropropene	8260	BDL	10.0	ug/l
		Toluene	8260	210	10.0	ug/l
		trans-1,3-Dichloropropene	8260	BDL	10.0	ug/l
		1,1,2-Trichloroethane	8260	BDL	10.0	ug/l
		2-Hexanone	8260	BDL	10.0	ug/l
		1,3-Dichloropropane	8260	BDL	10.0	ug/l
		Tetrachloroethene	8260	BDL	10.0	ug/l
		Dibromochloromethane	8260	BDL	10.0	ug/l
		Dibromomethane	8260	BDL	10.0	ug/l
		Chlorobenzene	8260	BDL	10.0	ug/l
		1,1,1,2-Tetrachloroethane	8260	BDL	10.0	ug/l
		Ethylbenzene	8260	BDL	10.0	ug/l
		Xylenes, Total	8260	11.2	10.0	ug/l
		Styrene	8260	BDL	10.0	ug/l
		Bromoform	8260	BDL	10.0	ug/l
		1,2,3-Trichloropropane	8260	BDL	10.0	ug/l
		1,1,2,2-Tetrachloroethane	8260	BDL	10.0	ug/l
		1,3-Dichlorobenzene	8260	BDL	10.0	ug/l
		1,4-Dichlorobenzene	8260	BDL	10.0	ug/l
		1,2-Dichlorobenzene	8260	BDL	10.0	ug/l

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Client Project Name:	Fansteel Wellman Dynamics
Date Submitted:	24-Sep-98
Date Reported:	10-Nov-98
Page:	2 of 8

		Parameter	Method	Result	Detection Limit	Units
Client Sample ID:	Leachate	**TOTAL SEMI-VOLATILES**				
Lab Sample ID:	980922	Phenol	8270	28.0	10	ug/l
Sample Matrix:	unfilt groundwater	bis(2-Chloroethyl)ether	8270	BDL	10	ug/l
Date Sampled:	9/23/98	2-Chlorophenol	8270	BDL	10	ug/l
		1,3-Dichlorobenzene	8270	BDL	10	ug/l
		1,4-Dichlorobenzene	8270	BDL	10	ug/l
		1,2-Dichlorobenzene	8270	BDL	10	ug/l
		2-Methylphenol	8270	23.1	10	ug/l
		2,2'-oxybis-(1-Chloropropane)	8270	BDL	10	ug/l
		4-Methylphenol	8270	BDL	10	ug/l
		n-Nitroso-di-n-propylamine	8270	BDL	10	ug/l
		Hexachloroethane	8270	BDL	10	ug/l
		Nitrobenzene	8270	BDL	10	ug/l
		Isophorone	8270	BDL	10	ug/l
		2-Nitrophenol	8270	BDL	10	ug/l
		2,4-Dimethylphenol	8270	BDL	20	ug/l
		bis(2-Chloroethoxy)methane	8270	BDL	20	ug/l
		2,4-Dichlorophenol	8270	BDL	10	ug/l
		1,2,4-Trichlorobenzene	8270	BDL	10	ug/l
		Naphthalene	8270	217	10	ug/l
		4-Chloroaniline	8270	BDL	10	ug/l
		Hexachlorobutadiene	8270	BDL	10	ug/l
		4-Chloro-3-methylphenol	8270	BDL	10	ug/l
		2-Methylnaphthalene	8270	BDL	10	ug/l
		Hexachlorocyclopentadiene	8270	BDL	10	ug/l
		2,4,6-Trichlorophenol	8270	BDL	10	ug/l
		2,4,5-Trichlorophenol	8270	BDL	10	ug/l
		2-Chloronaphthalene	8270	BDL	10	ug/l
		2-Nitroaniline	8270	BDL	10	ug/l
		Dimethylphthalate	8270	BDL	10	ug/l
		Acenaphthylene	8270	BDL	10	ug/l
		3-Nitroaniline	8270	BDL	10	ug/l
		Acenaphthene	8270	BDL	10	ug/l
		2,4-Dinitrophenol	8270	BDL	10	ug/l
		4-Nitrophenol	8270	BDL	10	ug/l
		Dibenzofuran	8270	BDL	10	ug/l
		2,4-Dinitrotoluene	8270	BDL	20	ug/l
		2,6-Dinitrotoluene	8270	BDL	10	ug/l
		Diethylphthalate	8270	BDL	10	ug/l
		4-Chlorophenyl phenyl ether	8270	BDL	20	ug/l
		Fluorene	8270	BDL	20	ug/l
		4-Nitroaniline	8270	BDL	10	ug/l
		4,6-Dinitro-2-methylphenol	8270	BDL	20	ug/l

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Date Reported:	10-Nov-98
Page:	3 of 8

		Parameter	Method	Result	Detection Limit	Units
Client Sample ID:	Leachate	**TOTAL SEMI-VOLATILES(cont).**				
Lab Sample ID:	980922	n-Nitrosodiphenylamine	8270	BDL	10	ug/l
Sample Matrix:	unfilt groundwater	4-Bromophenyl phenyl ether	8270	BDL	10	ug/l
Date Sampled:	9/23/98	Hexachlorobenzene	8270	BDL	10	ug/l
		Pentachlorophenol	8270	BDL	20	ug/l
		Phenanthrene	8270	BDL	10	ug/l
		Anthracene	8270	BDL	10	ug/l
		Carbazole	8270	BDL	10	ug/l
		di-n-butylphthalate	8270	BDL	10	ug/l
		Fluoranthene	8270	BDL	10	ug/l
		Pyrene	8270	BDL	10	ug/l
		Butylbenzylphthalate	8270	BDL	20	ug/l
		3,3'-Dichlorobenzidine	8270	BDL	10	ug/l
		Benzo(a)anthracene	8270	BDL	10	ug/l
		bis(2-Ethylhexyl)phthalate	8270	23.2	10	ug/l
		Chrysene	8270	BDL	10	ug/l
		di-n-Octylphthalate	8270	BDL	10	ug/l
		Benzo(b)fluoranthene	8270	BDL	10	ug/l
		Benzo(k)fluoranthene	8270	BDL	10	ug/l
		Benzo(a)pyrene	8270	BDL	10	ug/l
		Indeno(1,2,3-cd)pyrene	8270	BDL	10	ug/l
		Dibenz(a,h)anthracene	8270	BDL	10	ug/l
		Benzo(g,h,i)perylene	8270	BDL	10	ug/l

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Client Project Name:	Fansteel Wellman Dynamics
Date Submitted:	24-Sep-98
Date Reported:	10-Nov-98
Page:	4 of 8

1st set

		Parameter	Method	Result	Detection Limit	Units	Date Analyzed
Client Sample ID:	Leachate	**Metals**					
Lab Sample ID:	980922	Aluminum	EPA6010B	1.46	0.05	mg/l	10/10/98
Sample Matrix:	unfilt groundwater	Arsenic	EPA7060A	BDL	0.005	mg/l	10/26/98
Date Sampled:	9/23/98	Barium	EPA6010B	BDL	0.02	mg/l	10/10/98
		Cadmium	EPA6010B	BDL	0.01	mg/l	10/10/98
		Chromium	EPA6010B	BDL	0.01	mg/l	10/10/98
		Copper	EPA6010B	BDL	0.02	mg/l	10/10/98
		Iron	EPA6010B	25.6	0.02	mg/l	10/10/98
		Lead	EPA7421	BDL	0.005	mg/l	10/1/98
		Magnesium	EPA6010B	598	0.10	mg/l	10/10/98
		Manganese	EPA6010B	8.3	0.01	mg/l	10/10/98
		Mercury	EPA7470A	BDL	0.0002	mg/l	9/30/98
		Nickel	EPA6010B	BDL	0.02	mg/l	10/10/98
		Potassium	EPA6010B	600	0.43	mg/l	9/25/98
		Selenium	EPA7740	BDL	0.005	mg/l	10/23/98
		Silver	EPA6010B	BDL	0.01	mg/l	10/10/98
		Zinc	EPA6010B	0.239	0.02	mg/l	10/10/98
		General Chemistry					
		Biochemical Oxygen Demand	SM5210	14.0	2.0	mg/l	9/25/98
		Chemical Oxygen Demand	EPA410.2	75.9	17.0	mg/l	10/1/98
		Total Solids	EPA160.3	7300	20.0	mg/l	9/30/98
		Total Suspended Solids	EPA160.2	70.0	1.0	mg/l	9/24/98
		TKN as N	EPA351.3	14.6	1.0	mg/l	9/30/98
		Ammonia as N	EPA350.3	18.1	0.2	mg/l	9/28/98
		pH	EPA150.1	6.87			9/24/98
		Bicarbonate Alkalinity as $CaCO_3$	EPA310.1	700	2.0	mg/l	9/24/98
		Sulfate	EPA375.4	1270	100	mg/l	10/8/98
		Fluoride	EPA340.2	83.2	3.0	mg/l	9/28/98
		Total Organic Carbon	EPA415.2	262	2.0	mg/l	10/1/98
		Oil & Grease	EPA413.1	BDL	5.0	mg/l	10/12/98
		Chloride	SM4500-Cl	1510	5.0	mg/l	9/30/98
		Nitrate as NO_3 by Brucine	EPA352.1	3.8	1.8	mg/l	9/29/98
		Total Phosphate as P	SM4500 P	BDL	0.1	mg/l	10/16/98
		Total Dissolved Solids	EPA160.1	6160	5.0	mg/l	9/30/98
		Total Volatile Solids	EPA160.4	2190	50.0	mg/l	9/30/98
		Herbicides					
		2,4-D	EPA8151	BDL	0.05	ug/l	10/9/98
		2,4,5-TP	EPA8151	BDL	0.05	ug/l	10/9/98

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Client Project Name:	Fansteel Wellman Dynamics
Date Submitted:	24-Sep-98
Date Reported:	10-Nov-98
Page:	5 of 8

Client Sample ID:	Lab Sample ID:	Parameter	Method	Result	Detection Limit	Units	Date Analyzed
Client Sample ID:	Leachate	**Pesticides**					
Lab Sample ID:	980922	Aldrin	8081	BDL	0.02	ug/l	11/4/98
Sample Matrix:	unfilt groundwater	Alpha-BHC	8081	BDL	0.02	ug/l	11/4/98
Date Sampled:	9/23/98	Beta-BHC	8081	BDL	0.02	ug/l	11/4/98
		Delta-BHC	8081	BDL	0.02	ug/l	11/4/98
		Gamma-BHC	8081	BDL	0.02	ug/l	11/4/98
		DDE	8081	BDL	0.02	ug/l	11/4/98
		DDD	8081	BDL	0.02	ug/l	11/4/98
		DDT	8081	BDL	0.02	ug/l	11/4/98
		Dieldrin	8081	BDL	0.02	ug/l	11/4/98
		Endosulfan I	8081	BDL	0.02	ug/l	11/4/98
		Endosulfan II	8081	BDL	0.02	ug/l	11/4/98
		Endosulfan Sulfate	8081	BDL	0.02	ug/l	11/4/98
		Endrin	8081	BDL	0.02	ug/l	11/4/98
		Endrin Aldehyde	8081	BDL	0.02	ug/l	11/4/98
		Heptachlor	8081	BDL	0.02	ug/l	11/4/98
		Heptachlor Epoxide	8081	BDL	0.02	ug/l	11/4/98
		Methoxychlor	8081	BDL	0.02	ug/l	11/4/98

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Client Project Name:	Fansteel Wellman Dynamics
Date Submitted:	24-Sep-98
Date Reported:	10-Nov-98
Page:	6 of 8

Client Sample ID: Leachate
Lab Sample ID: 980922
Sample Matrix: unfilt groundwater
Date Sampled: 9/23/98

Radiological	Method		Result		MDA	Units	Date Analyzed
Thorium 232	LANLER200	0.2	+/-	0.1	0.1	pCi/L	10/30/98
Thorium 230	LANLER200	0.1	+/-	0.2	0.2	pCi/L	10/30/98
Thorium 228	LANLER200	0.2	+/-	0.2	0.2	pCi/L	10/30/98
Uranium 238	ASTM5174M		BDL		0.3	pCi/L	11/6/98
Radium 226	SM705M	0.5	+/-	0.5	0.2	pCi/L	10/16/98
Gross Alpha	EPA900	0	+/-	38.1	44.6	pCi/L	10/30/98
Gross Beta	EPA900	663	+/-	95.2	74.1	pCi/L	10/30/98
K-40	EPA6010B		521		0.43	pCi/L	9/25/98

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Date Submitted:	24-Sep-98
Date Reported:	10-Nov-98
Page:	7 of 8

QC REPORT

	Date Extracted	Date Analyzed	Analyst	Blank	LCS %REC	MS %REC	MSD %REC	% RPD
Volatiles								
1,1-Dichloroethene		9/28/98	BD	<10	103	104	106	2.1
Benzene		9/28/98	BD	<10	104	105	113	6.9
Trichloroethene		9/28/98	BD	<10	98	97	104	6.1
Toluene		9/28/98	BD	<10	103	73	77	5.1
Chlorobenzene		9/28/98	BD	<10	99	96	105	9.3
Semi-Volatiles								
Phenol	9/28/98	9/29/98	BD	<10	74	92	56	48
2-Chlorophenol	9/28/98	9/29/98	BD	<10	104	94	89	5
1, 4-Dichlorobenzene	9/28/98	9/29/98	BD	<10	80	66	63	5
n-Nitroso-di-n-propylamine	9/28/98	9/29/98	BD	<10	116	106	95	11
1,2,4-Trichlorobenzene	9/28/98	9/29/98	BD	<10	87	65	61	6
4-Chloro-3-methylphenol	9/28/98	9/29/98	BD	<10	97	99	78	23
Acenaphthene	9/28/98	9/29/98	BD	<10	106	104	86	20
4-Nitrophenol	9/28/98	9/29/98	BD	<10	50	76	69	10
2,4-Dinitrotoluene	9/28/98	9/29/98	BD	<10	108	148	127	15
Pentachlorophenol	9/28/98	9/29/98	BD	<10	99	159	149	6
Pyrene	9/28/98	9/29/98	BD	<10	159	145	133	8
2,4-D		10/9/98	BD	<.05	76	57	62	48
2,4,5-TP		10/9/98	BD	<.05	74	93	88	35
Total Phosphate as P		10/16/98	RT	<0.1	99.6	83.9		NC
Oil & Grease		10/12/98	RT	<5.0	84.1			
TDS		9/30/98	RT	<5.0	99.2			0.62
TS		9/30/98	RT	50				1.4
TVS		9/30/98	RT	<50				1.9
Sulfate		10/8/98	RT	<100	98.1	101		1.1
BOD		9/25-30/98	RT	<2.0	113			2.9
Chloride		9/30/98	RT	<5.0	100	97		0.3
COD		10/1/98	RT	<17	92.7	98.5		1.5
TKN as N		9/30/98	RT	<1.0	94.5	115		4.1
Nitrate as NO_3 by Brucine		9/29/98	RT	<1.8	106	111		2.1
Total Organic Carbon		10/1/98	BD	<2.0	99	109		1.7
Ammonia as N		9/28/98	RT	<0.2	94.4	113		0.8
Fluoride		9/28/98	RT	<3.0	102	103		2.0
TSS		9/24/98	RT	<1.0				0
pH		9/24/98	RT					0.15
Bicarbonate Alkalinity as $CaCO_3$		9/24/98	RT	<2.0	99.8	99.9		0.43

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Date Submitted:	24-Sep-98
Date Reported:	10-Nov-98
Page:	8 of 8

QC REPORT

	Date Extracted	Date Analyzed	Analyst	Blank	LCS %REC	MS %REC	MSD %REC	% RPD
Metals								
K-40		9/25/98	BD	<0.43	85.2	84.7	76.3	10.4
Aluminum		10/10/98	BD	<.05	93.1	95	111	15.1
Arsenic		10/26/98	BD	<.005	102	108	106	1.9
Barium		10/10/98	BD	<.02	99.1	93.2	102	9.1
Cadmium		10/10/98	BD	<.01	103	91.3	100	9.4
Chromium		10/10/98	BD	<.01	99.3	87.8	96.9	9.9
Copper		10/10/98	BD	<.02	94.1	79.4	86.5	8.5
Iron		10/10/98	BD	<.05	93.5	D	D	14.7
Lead		10/1/98	BD	<.005	102	94	92	2.1
Magnesium		10/10/98	BD	<.10	94.6	D	D	6.1
Manganese		10/10/98	BD	<.01	98.4	D	D	12.9
Mercury		10/10/98	BD	<.0002	104	109	117	7.1
Nickel		10/10/98	BD	<.02	101	88.3	96.2	8.6
Selenium		10/10/98	BD	<.005	90	104	102	1.9
Silver		10/10/98	BD	<.01	101	92.7	100	7.7
Zinc		10/10/98	BD	<.02	98.0	86.8	97.2	11.3
Pesticides								
delta-BHC	10/16/98	11/4/98	BD	<.02	106	123	86	35
Heptachlor	10/16/98	11/4/98	BD	<.02	90	93	66	35
Heptachlor epoxide	10/16/98	11/4/98	BD	<.02	91	100	73	31
Endrin	10/16/98	11/4/98	BD	<.02	83	95	91	5
Methoxychlor	10/16/98	11/4/98	BD	<.02	85	102	75	30
Radiological								
Ra-226		10/16/98	RE	0.0+/-0.2	104	95.0		NC
Gross Alpha		10/30/98	RE	0 +/- 0.1	66.5	78.0	110	NC
Gross Beta		10/30/98	RE	0 +/- 0.6	86.4	94.2	91.4	NC
Th-232		10/30/98	RE	0.1 +/-0.1	102	105		NC
Th-230		10/30/98	RE	0.0 +/-0.1				NC
Th-228		10/30/98	RE	0.1+/-0.2	100	91.2		NC
U-238		11/6/98	RE	<1	99.8	91.0	87.4	4.0

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Laboratory Approvals:

QA/QC Officer

Laboratory Director

Outreach Laboratory
311 North Aspen
Broken Arrow, Ok 74012
(918) 251-2515
FAX (918) 251-0008

Lab Project Number:	981336
Client:	Earth Sciences
Client Project Number:	4764A-02
Client Project Name:	Fansteel Wellman Dynamics
Date Submitted:	29-Dec-98
Date Reported:	20-Jan-99
Page:	1 of 3

		Parameter	Method	Result	Detection Limit	Units	
Client Sample ID:	Leachate Filtered	**Metals**					
Lab Sample ID:	981336-01	Aluminum	EPA6010B	1.45	0.10	mg/l	1/6/99
Sample Matrix:	filt groundwater	Arsenic	EPA7060A	BDL	0.005	mg/l	1/5/99
Date Sampled:	Unknown	Barium	EPA6010B	BDL	0.02	mg/l	1/6/99
		Cadmium	EPA6010B	BDL	0.01	mg/l	1/6/99
		Chromium	EPA6010B	BDL	0.01	mg/l	1/6/99
		Copper	EPA6010B	BDL	0.02	mg/l	1/6/99
		Iron	EPA6010B	16.9	0.05	mg/l	1/6/99
		Lead	EPA7421	BDL	0.005	mg/l	1/7/99
		Magnesium	EPA6010B	708	0.05	mg/l	1/6/99
		Manganese	EPA6010B	8.07	0.01	mg/l	1/6/99
		Mercury	EPA7470A	BDL	0.0002	mg/l	1/8/99
		Nickel	EPA6010B	BDL	0.02	mg/l	1/6/99
		Potassium	EPA6010B	1140	1.00	mg/l	1/19/99
		Selenium	EPA7740	BDL	0.01	mg/l	1/13/99
		Silver	EPA6010B	BDL	0.01	mg/l	1/6/99
		Zinc	EPA6010B	BDL	0.02	mg/l	1/6/99
		General Chemistry					
		Biochemical Oxygen Demand	SM5210	1.3	1.0	mg/l	12/30/98
		Chemical Oxygen Demand	EPA410.2	140	50.0	mg/l	12/30/98
		Total Solids	EPA160.3	2500	50	mg/l	12/2998
		Total Suspended Solids	EPA160.2	30.2	0.2	mg/l	12/2998
		TKN as N	EPA351.3	19.7	0.5	mg/l	1/4/99
		Ammonia as N	EPA350.3	17.5	0.2	mg/l	1/4/99
		pH	EPA150.1	7.03			12/29/98
		Bicarbonate Alkalinity as $CaCO_3$	EPA310.1	597	2.0	mg/l	12/29/98
		Sulfate	EPA375.4	1530	100	mg/l	1/5/99
		Fluoride	EPA340.2	66.5	2.0	mg/l	1/5/99
		Total Organic Carbon	EPA415.2	175	2.0	mg/l	1/5/99
		Oil & Grease	EPA413.2	6.5	1.0	mg/l	1/7/99
		Chloride	EPA325.3	1640	10	mg/l	1/6/99
		Nitrate as NO_3 by Brucine	EPA352.1	BDL	0.4	mg/l	1/4/99
		Total Phosphate as P	SM4500 -9	BDL	0.1	mg/l	12/30/98
		Total Dissolved Solids	EPA160.1	2520	10	mg/l	12/29/98
		Total Volatile Solids	EPA160.4	622	50	mg/l	12/29/98

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Client Project Name:	Fansteel Wellman Dynamics
Date Submitted:	29-Dec-98
Date Reported:	20-Jan-99
Page:	2 of 3

		Parameter	Method	Result	Detection Limit	Units	
Client Sample ID:	Leachate Unfilterec	**Metals**					
Lab Sample ID:	981336-02	Aluminum	EPA6010B	4.97	0.10	mg/l	1/6/99
Sample Matrix:	unfilt groundwater	Arsenic	EPA7060A	BDL	0.005	mg/l	1/5/99
Date Sampled:	Unknown	Barium	EPA6010B	BDL	0.02	mg/l	1/6/99
		Cadmium	EPA6010B	BDL	0.01	mg/l	1/6/99
		Chromium	EPA6010B	0.033	0.01	mg/l	1/6/99
		Copper	EPA6010B	BDL	0.02	mg/l	1/6/99
		Iron	EPA6010B	71.9	0.05	mg/l	1/6/99
		Lead	EPA7421	BDL	0.005	mg/l	1/7/99
		Magnesium	EPA6010B	399	0.05	mg/l	1/6/99
		Manganese	EPA6010B	5.85	0.01	mg/l	1/6/99
		Mercury	EPA7470A	BDL	0.0002	mg/l	1/8/99
		Nickel	EPA6010B	0.030	0.02	mg/l	1/6/99
		Potassium	EPA6010B	661	1.00	mg/l	1/19/99
		Selenium	EPA7740	BDL	0.01	mg/l	1/13/99
		Silver	EPA6010B	BDL	0.01	mg/l	1/6/99
		Zinc	EPA6010B	1.42	0.02	mg/l	1/6/99
		General Chemistry					
		Biochemical Oxygen Demand	SM5210	17.5	2.0	mg/l	12/30/98
		Chemical Oxygen Demand	EPA410.2	189	50.0	mg/l	12/30/98
		Total Solids	EPA160.3	7380	50	mg/l	12/2998
		Total Suspended Solids	EPA160.2	270	2.0	mg/l	12/2998
		TKN as N	EPA351.3	20	0.5	mg/l	1/4/99
		Ammonia as N	EPA350.3	17.9	0.2	mg/l	1/4/99
		pH	EPA150.1	7.00			12/29/98
		Bicarbonate Alkalinity as $CaCO_3$	EPA310.1	634	2.0	mg/l	12/29/98
		Sulfate	EPA375.4	1510	100	mg/l	1/5/99
		Fluoride	EPA340.2	66.5	2.0	mg/l	1/5/99
		Total Organic Carbon	EPA415.2	180	2.0	mg/l	1/5/99
		Oil & Grease	EPA413.2	8.8	1.0	mg/l	1/7/99
		Chloride	EPA325.3	1630	10	mg/l	1/6/99
		Nitrate as NO_3 by Brucine	EPA352.1	BDL	0.4	mg/l	1/4/99
		Total Phosphate as P	SM4500 -9	0.11	0.1	mg/l	12/30/98
		Total Dissolved Solids	EPA160.1	6270	10	mg/l	12/29/98
		Total Volatile Solids	EPA160.4	1950	50	mg/l	12/29/98

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Client Project Name:	Fansteel Wellman Dynamics
Date Submitted:	29-Dec-98
Date Reported:	20-Jan-99
Page:	3 of 3

QC REPORT

	Date Extracted	Date Analyzed	Analyst	Blank	LCS %REC	MS %REC	MSD %REC	% RPD
Metals								
Aluminum		1/6/99	BD	<.05	97	83	91	8.9
Arsenic		1/5/99	BD	<.005	106	98	106	8.6
Barium		1/6/99	BD	<.02	103	85	92	8.2
Cadmium		1/6/99	BD	<.01	101	80	85	5.9
Chromium		1/6/99	BD	<.01	98	75	84	10.2
Copper		1/6/99	BD	<.02	110	87	92	6.3
Iron		1/6/99	BD	<.05	96	D	D	11.6
Lead		1/7/99	BD	<.005	96	104	101	2.9
Magnesium		1/6/99	BD	<.10	105	D	D	7.9
Manganese		1/6/99	BD	<.01	104	109	100	8.3
Mercury		1/8/99	BD	<.02	108	104	96	8.8
Nickel		1/6/99	BD	<.02	101	79	85	8.0
Potassium		1/19/99	BD	<1	95.3	D	D	
Selenium		1/13/99	BD	<.01	108	81	87	7.4
Silver		1/6/99	BD	<.01	98	86	88	2.1
Zinc		1/6/99	BD	<.02	96	84	89	6.6
General Chemistry								
Total Phosphate as P		12/30/98	RT	<0.1	89.6	108		NC
Oil & Grease		1/7/99	RT	<1.0	89.9			
TDS		12/29/98	RT	<10	106			0.3
TS		12/29/98	RT	<50				1.6
TVS		12/29/98	RT	<50				0.3
Sulfate		1/5/99	RT	<100	111	112		0.9
BOD		12/30-1/4/99	RT	<2.0	83.8			2.1
Chloride		1/6/99	RT	<10	99.3	105		0.6
COD		12/30/98	RT	<50	94.5	90.6		8.7
TKN as N		1/4/99	RT	<0.5	102	99.4		1.6
Nitrate as NO_3 by Brucine		1/4/99	RT	<0.4	98	88.9		3.4
Total Organic Carbon		1/5/99	BD	<2.0	101	107		0.6
Ammonia as N		1/4/99	RT	<0.2	93.4	103		1.7
Fluoride		1/5/99	RT	<2.0	99.6	99.4		0.4
TSS		12/29/98	RT	<2.0				0
pH		12/29/98	RT		99.9			0.3
Bicarbonate Alkalinity as $CaCO_3$		12/29/98	RT	<2.0	98.4	94.8		0.5

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Laboratory Approvals:

QA/QC Officer

Laboratory Director

OUTREACH TECHNOLOGIES, INC.

311 North Aspen
Broken Arrow, OK 74012
Phone: (918) 251-2515
Fax: (918) 251-0008

CLIENT Earth Sciences		BILL TO:	
CONTACT Ellen Jakub		CONTACT	
ADDRESS		ADDRESS	
CITY	STATE ZIP	CITY	STATE ZIP
PHONE		PHONE	
FAX		FAX	

CHAIN OF CUSTODY RECORD

PROJECT NO. 4764A-02
PROJECT NAME Farstel Wellman Dynamics
TURNAROUND TIME
SAMPLER
(SIGNATURE)

LAB SAMPLE #	CLIENT SAMPLE ID	DATE SAMPLED	TIME SAMPLED	MATRIX	# CONTAINERS	Al, As, Ba, Be, Cd, Cr, Cu, Fe, Pb, Mg, Mn, Hg, Ni, K, Se, Ag, Zn	BOD	COD	Total Solids	TSS	TDS	TVS	TKN as N	Ammonia as N	NO_3(N) by Brucine	Oil & Grease	COMMENTS
	Leachate Filtered G.W.			Ground H_2O	6	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
	Leachate Unfiltered G.W.			Ground H_2O	6	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	

RELINQUISHED BY	DATE	TIME	RECEIVED BY	RELINQUISHED BY	DATE	TIME	RECEIVED BY
[signature]	12-28-98	3:00	[signature] 12/29/98 0900				

REMARKS:

1 of 2

981336

OUTREACH TECHNOLOGIES, INC.

311 North Aspen
Broken Arrow, OK 74012
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CLIENT Earth Sciences
CONTACT Ellen Jakub
ADDRESS
CITY STATE ZIP
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BILL TO:
CONTACT
ADDRESS
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FAX

CHAIN OF CUSTODY RECORD

PROJECT NO. 4764 A-02
PROJECT NAME Fansteel Wellman Dynamics
TURNAROUND TIME
SAMPLER
(SIGNATURE)

ANALYSIS REQUESTED

LAB SAMPLE #	CLIENT SAMPLE ID	DATE SAMPLED	TIME SAMPLED	MATRIX	# CONTAINERS	pH	Bicarbonate Alkalinity as $CaCO_3$	Sulfate	F	Cl	TOC	Total Phosphate as P					COMMENTS
	Leachate Filtered			Groundwater	6	✓	✓	✓	✓	✓	✓	✓					
	Leachate Unfiltered			Groundwater	6	✓	✓	✓	✓	✓	✓	✓					

RELINQUISHED BY:	DATE	TIME	RECEIVED BY:	RELINQUISHED BY:	DATE	TIME	RECEIVED BY:
[signature]	12/29/97	0700					
RELINQUISHED BY:	DATE	TIME	RECEIVED BY:	RELINQUISHED BY:	DATE	TIME	RECEIVED BY:

REMARKS:

981336

Outreach Laboratory
311 North Aspen
Broken Arrow, Ok 74012
(918) 251-2515
FAX (918) 251-0008

Lab Project Number:	981338
Client:	Earth Sciences
Client Project Number:	4764A-02
Client Project Nane:	Fansteel Wellman Dyn
Date Submitted:	29-Dec-98
Date Reported:	20-Jan-99
Page:	1 of 4

		Parameter	Method	Result	Detection Limit	Units
Client Sample ID:	Leachate Unfiltered	TOTAL VOLATILE ORGANICS				
Lab Sample ID:	981338	Bromomethane	8260	BDL	5.0	ug/l
Sample Matrix:	groundwater	Chloroethane	8260	BDL	5.0	ug/l
Date Sampled:	Unknown	Chloromethane	8260	BDL	10.0	ug/l
		Dichlorodifluoromethane	8260	BDL	10.0	ug/l
		Vinyl chloride	8260	BDL	5.0	ug/l
		1,1-Dichloroethene	8260	BDL	5.0	ug/l
		Acetone	8260	BDL	15.0	ug/l
		Methylene chloride	8260	BDL	5.0	ug/l
		trans-1,2-dichloroethene	8260	BDL	5.0	ug/l
		1,1-Dichloroethane	8260	36.4	5.0	ug/l
		cis-1,2-Dichloroethene	8260	BDL	5.0	ug/l
		2-Butanone	8260	BDL	5.0	ug/l
		Chloroform	8260	BDL	5.0	ug/l
		Bromochloromethane	8260	BDL	5.0	ug/l
		1,1,1-Trichloroethane	8260	BDL	5.0	ug/l
		Carbon tetrachloride	8260	BDL	5.0	ug/l
		1,2-Dichloroethane	8260	BDL	5.0	ug/l
		1,2-Dichloropropane	8260	BDL	5.0	ug/l
		Benzene	8260	BDL	5.0	ug/l
		Trichloroethene	8260	BDL	5.0	ug/l
		Bromodichloromethane	8260	BDL	5.0	ug/l
		4-Methyl-2-pentanone	8260	BDL	5.0	ug/l
		cis-1,3-Dichloropropene	8260	BDL	5.0	ug/l
		Toluene	8260	35.8	5.0	ug/l
		trans-1,3-Dichloropropene	8260	BDL	5.0	ug/l
		1,1,2-Trichloroethane	8260	BDL	5.0	ug/l
		2-Hexanone	8260	BDL	5.0	ug/l
		1,3-Dichloropropane	8260	BDL	5.0	ug/l
		Tetrachloroethene	8260	BDL	5.0	ug/l
		Dibromochloromethane	8260	BDL	5.0	ug/l
		Dibromomethane	8260	BDL	5.0	ug/l
		Chlorobenzene	8260	BDL	5.0	ug/l
		1,1,1,2-Tetrachloroethane	8260	BDL	5.0	ug/l
		Ethylbenzene	8260	BDL	5.0	ug/l
		Xylenes, Total	8260	BDL	5.0	ug/l
		Styrene	8260	BDL	5.0	ug/l
		Bromoform	8260	BDL	5.0	ug/l
		1,2,3-Trichloropropane	8260	BDL	5.0	ug/l
		1,1,2,2-Tetrachloroethane	8260	BDL	5.0	ug/l
		1,3-Dichlorobenzene	8260	BDL	10.0	ug/l
		1,4-Dichlorobenzene	8260	BDL	5.0	ug/l
		1,2-Dichlorobenzene	8260	BDL	5.0	ug/l

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Lab Project Number:	981338
Client:	Earth Sciences
Client Project Number:	4764A-02
Client Project Nane:	Fansteel Wellman Dyn
Date Submitted:	29-Dec-98
Date Reported:	20-Jan-99
Page:	2 of 4

		Parameter	Method	Result	Detection Limit	Units
Client Sample ID:	Leachate Unfiltered	TOTAL SEMI-VOLATILES				
Lab Sample ID:	981338	Phenol	8270A	75.0	10	ug/l
Sample Matrix:	groundwater	bis(2-Chloroethyl)ether	8270A	BDL	10	ug/l
Date Sampled:	Unknown	2-Chlorophenol	8270A	BDL	10	ug/l
		1,3-Dichlorobenzene	8270A	BDL	10	ug/l
		1,4-Dichlorobenzene	8270A	BDL	10	ug/l
		1,2-Dichlorobenzene	8270A	BDL	10	ug/l
		2-Methylphenol	8270A	54.8	10	ug/l
		2,2'-oxybis-(1-Chloropropane)	8270A	BDL	10	ug/l
		4-Methylphenol	8270A	BDL	10	ug/l
		n-Nitroso-di-n-propylamine	8270A	BDL	10	ug/l
		Hexachloroethane	8270A	BDL	10	ug/l
		Nitrobenzene	8270A	BDL	10	ug/l
		Isophorone	8270A	BDL	10	ug/l
		2-Nitrophenol	8270A	BDL	10	ug/l
		2,4-Dimethylphenol	8270A	BDL	20	ug/l
		bis(2-Chloroethoxy)methane	8270A	BDL	20	ug/l
		2,4-Dichlorophenol	8270A	BDL	10	ug/l
		1,2,4-Trichlorobenzene	8270A	BDL	10	ug/l
		Naphthalene	8270A	527	10	ug/l
		4-Chloroaniline	8270A	BDL	10	ug/l
		Hexachlorobutadiene	8270A	BDL	10	ug/l
		4-Chloro-3-methylphenol	8270A	BDL	10	ug/l
		2-Methylnaphthalene	8270A	17.9	10	ug/l
		Hexachlorocyclopentadiene	8270A	BDL	10	ug/l
		2,4,6-Trichlorophenol	8270A	BDL	10	ug/l
		2,4,5-Trichlorophenol	8270A	BDL	10	ug/l
		2-Chloronaphthalene	8270A	BDL	10	ug/l
		2-Nitroaniline	8270A	BDL	10	ug/l
		Dimethylphthalate	8270A	BDL	10	ug/l
		Acenaphthylene	8270A	BDL	10	ug/l
		3-Nitroaniline	8270A	BDL	10	ug/l
		Acenaphthene	8270A	BDL	10	ug/l
		2,4-Dinitrophenol	8270A	BDL	10	ug/l
		4-Nitrophenol	8270A	BDL	10	ug/l
		Dibenzofuran	8270A	BDL	10	ug/l
		2,4-Dinitrotoluene	8270A	BDL	20	ug/l
		2,6-Dinitrotoluene	8270A	BDL	10	ug/l
		Diethylphthalate	8270A	BDL	10	ug/l
		4-Chlorophenyl phenyl ether	8270A	BDL	20	ug/l
		Fluorene	8270A	BDL	20	ug/l
		4-Nitroaniline	8270A	BDL	10	ug/l
		4,6-Dinitro-2-methylphenol	8270A	BDL	20	ug/l

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Client Project Nane:	Fansteel Wellman Dyn
Date Submitted:	29-Dec-98
Date Reported:	20-Jan-99
Page:	3 of 4

Parameter	Method	Result	Detection Limit	Units
TOTAL SEMI-VOLATILES(cont).				
n-Nitrosodiphenylamine	8270A	BDL	10	ug/l
4-Bromophenyl phenyl ether	8270A	BDL	10	ug/l
Hexachlorobenzene	8270A	BDL	10	ug/l
Pentachlorophenol	8270A	BDL	20	ug/l
Phenanthrene	8270A	BDL	10	ug/l
Anthracene	8270A	BDL	10	ug/l
Carbazole	8270A	BDL	10	ug/l
di-n-butylphthalate	8270A	BDL	10	ug/l
Fluoranthene	8270A	BDL	10	ug/l
Pyrene	8270A	BDL	10	ug/l
Butylbenzylphthalate	8270A	BDL	20	ug/l
3,3'-Dichlorobenzidine	8270A	BDL	10	ug/l
Benzo(a)anthracene	8270A	BDL	10	ug/l
bis(2-Ethylhexyl)phthalate	8270A	BDL	10	ug/l
Chrysene	8270A	BDL	10	ug/l
di-n-Octylphthalate	8270A	BDL	10	ug/l
Benzo(b)fluoranthene	8270A	BDL	10	ug/l
Benzo(k)fluoranthene	8270A	BDL	10	ug/l
Benzo(a)pyrene	8270A	BDL	10	ug/l
Indeno(1,2,3-cd)pyrene	8270A	BDL	10	ug/l
Dibenz(a,h)anthracene	8270A	BDL	10	ug/l
Benzo(g,h,i)perylene	8270A	BDL	10	ug/l

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Lab Project Number:	981338
Client:	Earth Sciences
Client Project Number:	4764A-02
Client Project Nane:	Fansteel Wellman Dyn
Date Submitted:	29-Dec-98
Date Reported:	20-Jan-99
Page:	4 of 4

QC REPORT

Volatiles	Date Analyzed	Analyst	Blank	LCS %REC	MS %REC	MSD %REC	% RPD
1,1-Dichloroethene	1/4/98	BD	<10	101	103	106	3.0
Benzene	1/4/98	BD	<10	104	106	108	2.8
Trichloroethene	1/4/98	BD	<10	99	100	104	4.4
Toluene	1/4/98	BD	<10	101	104	105	1.4
Chlorobenzene	1/4/98	BD	<10	102	106	111	4.8

Semi-Volatiles	Date Extracted	Date Analyzed	Analyst	Blank	LCS %REC	MS %REC	MSD %REC	% RPD
Phenol	12/30/98	1/19/98	BD	<10	59	58	62	7.0
2-Chlorophenol	12/30/98	1/19/98	BD	<10	62	75	88	15.7
1, 4-Dichlorobenzene	12/30/98	1/19/98	BD	<10	51	55	70	23.5
n-Nitroso-di-n-propylamine	12/30/98	1/19/98	BD	<10	62	64	74	14.2
1,2,4-Trichlorobenzene	12/30/98	1/19/98	BD	<10	55	52	70	30.2
4-Chloro-3-methylphenol	12/30/98	1/19/98	BD	<10	63	68	86	22.9
Acenaphthene	12/30/98	1/19/98	BD	<10	62	66	78	17.6
4-Nitrophenol	12/30/98	1/19/98	BD	<10	50	38	42	9.9
2,4-Dinitrotoluene	12/30/98	1/19/98	BD	<10	68	79	88	9.9
Pentachlorophenol	12/30/98	1/19/98	BD	<10	85	110	127	14.3
Pyrene	12/30/98	1/19/98	BD	<10	79	70	83	17.8

LABORATORY APPROVALS:

QA/QC Officer: ______________________

Laboratory Director: ______________________

OUTREACH TECHNOLOGIES, INC.
311 North Aspen
Broken Arrow, OK 74012
Phone: (918) 251-2515
Fax: (918) 251-0008

CLIENT Earth Sciences	BILL TO:
CONTACT Ellen Jakub	CONTACT
ADDRESS	ADDRESS
CITY STATE ZIP	CITY STATE ZIP
PHONE	PHONE
FAX	FAX

CHAIN OF CUSTODY RECORD

PROJECT NO. 4764A-02
PROJECT NAME Fansteel Wellman Dynamics
TURNAROUND TIME
SAMPLER
(SIGNATURE)

LAB SAMPLE #	CLIENT SAMPLE ID	DATE SAMPLED	TIME SAMPLED	MATRIX	# CONTAINER'S	Total Vol. Organics	Total Semi Vol. Org										COMMENTS
	Leachate Unfiltered			Groundwater	3 voa 2 1/2 gallon	✓	✓										

RELINQUISHED BY:	DATE	TIME	RECEIVED BY:	RELINQUISHED BY:	DATE	TIME	RECEIVED BY:
Dan Schultz	12-28-98	9:00 P	[signature] 12/29/98 0900				
RELINQUISHED BY:	DATE	TIME	RECEIVED BY	RELINQUISHED BY	DATE	TIME	RECEIVED BY:

REMARKS:

981338

TestAmerica
ANALYTICAL TESTING CORPORATION
704 Enterprise Drive Cedar Falls, IA 50613 * 800-750-2401 * Fax 319-277-2425

January 31, 2006

Client:
FANSTEEL/WELLMAN CORP.
1746 Commerce Road
Creston, IA 50801

Attn: Joe Haller

Work Order:	COL1216
Project Name:	Landfill Leachate Permit Renewal
Project Number:	Landfill Leachate Permit Renewal
Date Received:	12/28/05

An executed copy of the chain of custody is also included as an addendum to this report.

If you have any questions relating to this analytical report, please contact your Laboratory Project Manager at 1-(800)750-2401

SAMPLE IDENTIFICATION	LAB NUMBER	COLLECTION DATE AND TIME
Landfill Leachate	COL1216-01	12/27/05 09:20

Samples were received into laboratory at a temperature of 3 °C.

The reported results were obtained in compliance with the 2003 NELAC standards unless otherwise noted.

Reproduction of this analytical report is permitted only in its entirety. This report shall not be reproduced except in full without the written approval of the laboratory.

TestAmerica Analytical Testing Corporation certifies that the analytical results contained herein apply only to the specific sample analyzed.

Approved By:

TestAmerica Analytical - Cedar Falls
Derrick Klinkenberg
Organics Manager

Test America
ANALYTICAL TESTING CORPORATION

704 Enterprise Drive Cedar Falls, IA 50613 * 800-750-2401 * Fax 319-277-2425

FANSTEEL/WELLMAN CORP.
1746 Commerce Road
Creston, IA 50801
Joe Haller

Work Order: COL1216
Project: Landfill Leachate Permit Renewal
Project Number: Landfill Leachate Permit Renewal

Received: 12/28/05
Reported: 01/31/06 13:48

ANALYTICAL REPORT

Analyte	Sample Result	Data Qualifiers	Units	Quan. Limit	Dilution Factor	Date Analyzed	Analyst	Seq/ Batch	Method
Sample ID: COL1216-01 (Landfill Leachate - Ground Water)					**Sampled: 12/27/05 09:20**		**Recvd: 12/28/05 08:40**		
General Chemistry Parameters									
Alkalinity, bicarb (CaCO3)	**644**		mg/L	5.00	1	12/29/05 13:28	jcf	5120965	SM2320B
Alkalinity, Phenol. (CaCO3)	<5.00		mg/L	5.00	1	12/29/05 13:28	jcf	5120965	SM 2320B
Alkalinity, Total (CaCO3)	**644**		mg/L	5.00	1	12/29/05 13:24	jcf	5120954	SM 2320B
Ammonia as N	**10.5**		mg/L	1.50	3	12/29/05 17:27	jmh	5120985	SM 4500NH3 B,E
BOD - 5 Day	<12.0		mg/L	12.0	4	12/28/05 12:00	lbb	5120888	SM 5210B
Chemical Oxygen Demand	**219**		mg/L	25.0	1	12/29/05 14:37	jcf	5120970	SM 5220D
Chloride	**3000**		mg/L	250	50	01/03/06 11:21	mdk	6010017	SM 4500Cl E
Oil & Grease	<4.85		mg/L	4.85	1	12/29/05 21:04	cah	5120982	EPA 1664
pH	**7.6**	H3	pH Units	0.1	1	12/28/05 11:30	sas	5120896	EPA 150.1
Phosphorus, Total (as P)	**0.109**		mg/L	0.100	1	01/03/06 12:19	lbb	6010010	EPA 365.1
Sulfate	**1070**	M1	mg/L	333	33.3	01/09/06 14:59	mdk	6010255	ASTM D516-90
Total Dissolved Solids	**7720**		mg/L	20.0	1	12/29/05 08:00	sas	6010003	SM2540C
Total Kjeldahl Nitrogen	**15.8**		mg/L	1.00	1	12/30/05 13:29	jcf	5120937	EPA 351.2
Total Organic Carbon	**8.31**	ET	mg/L	2.00	2	01/04/06 20:14	jcf	6010057	SM 5310C
Total Solids	**9140**		mg/L	20.0	1	12/29/05 08:00	sas	6010062	SM 2540B
Total Suspended Solids	**7.00**		mg/L	3.00	1	12/28/05 15:00	lbb	5120951	USGS I-3765-85
Total Volatile Solids	**2960**		mg/L	20.0	1	12/29/05 08:00	sas	6010060	EPA 160.4
Fluoride	**110**		mg/L	15.0	15	01/10/06 07:49	lbb	6010305	SM 4500F BC
Nitrate as N	<1.00		mg/L	1.00	1	12/28/05 14:00	jcf	5120914	EPA 353.3
Total Metals by EPA 200 Series Methods									
Aluminum	**0.293**		mg/L	0.100	1	01/03/06 12:47	heh	5120994	EPA 200.7
Arsenic	**0.149**		mg/L	0.0800	1	01/03/06 12:47	heh	5120994	EPA 200.7
Barium	**0.121**		mg/L	0.0100	1	01/03/06 12:47	heh	5120994	EPA 200.7
Cadmium	<0.0200		mg/L	0.0200	1	01/03/06 12:47	heh	5120994	EPA 200.7
Chromium	<0.0200		mg/L	0.0200	1	01/03/06 12:47	heh	5120994	EPA 200.7
Copper	**0.502**		mg/L	0.0200	1	01/03/06 12:47	heh	5120994	EPA 200.7
Iron	**1.99**		mg/L	0.100	1	01/03/06 12:47	heh	5120994	EPA 200.7
Lead	**0.136**		mg/L	0.100	1	01/03/06 12:47	heh	5120994	EPA 200.7
Manganese	**7.89**		mg/L	0.0100	1	01/03/06 12:47	heh	5120994	EPA 200.7
Mercury	<0.000200		mg/L	0.000200	1	01/04/06 10:50	llw	6010059	EPA 245.2
Nickel	**0.0529**		mg/L	0.0500	1	01/03/06 12:47	heh	5120994	EPA 200.7
Potassium	**821**		mg/L	1.00	1	01/03/06 12:47	heh	5120994	EPA 200.7
Selenium	**0.508**		mg/L	0.150	1	01/03/06 12:47	heh	5120994	EPA 200.7
Silver	<0.0200		mg/L	0.0200	1	01/03/06 12:47	heh	5120994	EPA 200.7
Zinc	**0.490**		mg/L	0.100	5	01/03/06 12:47	heh	5120994	EPA 200.7
Magnesium	**798**		mg/L	1.00	1	01/03/06 12:47	heh	5120994	EPA 200.7
Volatile Organic Compounds									
Acetone	<10.0		ug/L	10.0	1	12/30/05 16:53	DMD	6010055	EPA 624
Benzene	**0.610**		ug/L	0.500	1	12/30/05 16:53	DMD	6010055	EPA 624
Bromodichloromethane	<1.00		ug/L	1.00	1	12/30/05 16:53	DMD	6010055	EPA 624
Bromoform	<5.00		ug/L	5.00	1	12/30/05 16:53	DMD	6010055	EPA 624
Bromomethane	<4.00		ug/L	4.00	1	12/30/05 16:53	DMD	6010055	EPA 624

TestAmerica Analytical - Cedar Falls
Derrick Klinkenberg
Organics Manager

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ANALYTICAL TESTING CORPORATION
704 Enterprise Drive Cedar Falls, IA 50613 * 800-750-2401 * Fax 319-277-2425

FANSTEEL/WELLMAN CORP.
1746 Commerce Road
Creston, IA 50801
Joe Haller

Work Order: COL1216
Project: Landfill Leachate Permit Renewal
Project Number: Landfill Leachate Permit Renewal

Received: 12/28/05
Reported: 01/31/06 13:48

ANALYTICAL REPORT

Analyte	Sample Result	Data Qualifiers	Units	Quan. Limit	Dilution Factor	Date Analyzed	Analyst	Seq/ Batch	Method
Sample ID: COL1216-01 (Landfill Leachate - Ground Water) - cont.					**Sampled: 12/27/05 09:20**		**Recvd: 12/28/05 08:40**		
Volatile Organic Compounds - cont.									
Carbon Tetrachloride	<2.00		ug/L	2.00	1	12/30/05 16:53	DMD	6010055	EPA 624
Chlorobenzene	<1.00		ug/L	1.00	1	12/30/05 16:53	DMD	6010055	EPA 624
Chloroethane	<4.00		ug/L	4.00	1	12/30/05 16:53	DMD	6010055	EPA 624
Chloroform	<1.00		ug/L	1.00	1	12/30/05 16:53	DMD	6010055	EPA 624
Chloromethane	<3.00	CIN	ug/L	3.00	1	12/30/05 16:53	DMD	6010055	EPA 624
Bromochloromethane	<5.00		ug/L	5.00	1	12/30/05 16:53	DMD	6010055	EPA 624
1,2,3-Trichloropropane	<1.00		ug/L	1.00	1	12/30/05 16:53	DMD	6010055	EPA 624
Chlorodibromomethane	<5.00		ug/L	5.00	1	12/30/05 16:53	DMD	6010055	EPA 624
1,2-Dibromoethane (EDB)	<10.0		ug/L	10.0	1	12/30/05 16:53	DMD	6010055	EPA 624
m,p-Xylene	<2.00		ug/L	2.00	1	12/30/05 16:53	DMD	6010055	EPA 624
o-Xylene	**1.58**		ug/L	1.00	1	12/30/05 16:53	DMD	6010055	EPA 624
1,2-Dichlorobenzene	<1.00		ug/L	1.00	1	12/30/05 16:53	DMD	6010055	EPA 624
1,3-Dichlorobenzene	<1.00		ug/L	1.00	1	12/30/05 16:53	DMD	6010055	EPA 624
1,4-Dichlorobenzene	<1.00		ug/L	1.00	1	12/30/05 16:53	DMD	6010055	EPA 624
Dichlorodifluoromethane	<3.00		ug/L	3.00	1	12/30/05 16:53	DMD	6010055	EPA 624
1,1-Dichloroethane	**14.7**		ug/L	1.00	1	12/30/05 16:53	DMD	6010055	EPA 624
1,2-Dichloroethane	<1.00		ug/L	1.00	1	12/30/05 16:53	DMD	6010055	EPA 624
1,1-Dichloroethene	<2.00		ug/L	2.00	1	12/30/05 16:53	DMD	6010055	EPA 624
cis-1,2-Dichloroethene	**7.34**		ug/L	1.00	1	12/30/05 16:53	DMD	6010055	EPA 624
trans-1,2-Dichloroethene	<1.00		ug/L	1.00	1	12/30/05 16:53	DMD	6010055	EPA 624
1,2-Dichloropropane	<1.00		ug/L	1.00	1	12/30/05 16:53	DMD	6010055	EPA 624
cis-1,3-Dichloropropene	<5.00		ug/L	5.00	1	12/30/05 16:53	DMD	6010055	EPA 624
trans-1,3-Dichloropropene	<5.00		ug/L	5.00	1	12/30/05 16:53	DMD	6010055	EPA 624
1,3-Dichloropropene (total)	<5.00		ug/L	5.00	1	12/30/05 16:53	DMD	6010055	EPA 624
Ethylbenzene	<1.00		ug/L	1.00	1	12/30/05 16:53	DMD	6010055	EPA 624
2-Hexanone	<10.0		ug/L	10.0	1	12/30/05 16:53	DMD	6010055	EPA 624
2-Butanone (MEK)	<10.0		ug/L	10.0	1	12/30/05 16:53	DMD	6010055	EPA 624
4-Methyl-2-pentanone (MIBK)	<10.0		ug/L	10.0	1	12/30/05 16:53	DMD	6010055	EPA 624
Methylene Chloride	<5.00		ug/L	5.00	1	12/30/05 16:53	DMD	6010055	EPA 624
Styrene	<1.00		ug/L	1.00	1	12/30/05 16:53	DMD	6010055	EPA 624
1,1,1,2-Tetrachloroethane	<1.00		ug/L	1.00	1	12/30/05 16:53	DMD	6010055	EPA 624
1,1,2,2-Tetrachloroethane	<1.00		ug/L	1.00	1	12/30/05 16:53	DMD	6010055	EPA 624
Tetrachloroethene	<1.00		ug/L	1.00	1	12/30/05 16:53	DMD	6010055	EPA 624
Trichloroethene	<1.00		ug/L	1.00	1	12/30/05 16:53	DMD	6010055	EPA 624
1,1,2-Trichloroethane	<1.00		ug/L	1.00	1	12/30/05 16:53	DMD	6010055	EPA 624
1,1,1-Trichloroethane	<1.00		ug/L	1.00	1	12/30/05 16:53	DMD	6010055	EPA 624
Vinyl chloride	**5.06**		ug/L	1.00	1	12/30/05 16:53	DMD	6010055	EPA 624
Xylenes, total	**2.53**		ug/L	2.00	1	12/30/05 16:53	DMD	6010055	EPA 624
Surr: Dibromofluoromethane (70-130%)	*106 %*								
Surr: Toluene-d8 (70-130%)	*99 %*								
Surr: 4-Bromofluorobenzene (70-130%)	*91 %*								
Semivolatile Organics by GC/MS									
Acenaphthene	<10.0		ug/L	10.0	1.06	01/10/06 18:27	ake	5120968	EPA 625
Acenaphthylene	<10.0		ug/L	10.0	1.06	01/10/06 18:27	ake	5120968	EPA 625

FANSTEEL/WELLMAN CORP.
1746 Commerce Road
Creston, IA 50801
Joe Haller

Work Order: COL1216
Project: Landfill Leachate Permit Renewal
Project Number: Landfill Leachate Permit Renewal

Received: 12/28/05
Reported: 01/31/06 13:48

ANALYTICAL REPORT

Sample ID: COL1216-01 (Landfill Leachate - Ground Water) - cont. **Sampled: 12/27/05 09:20** **Recvd: 12/28/05 08:40**

Semivolatile Organics by GC/MS - cont.

Analyte	Sample Result	Data Qualifiers	Units	Quan. Limit	Dilution Factor	Date Analyzed	Analyst	Seq/ Batch	Method
Anthracene	<10.0		ug/L	10.0	1.06	01/10/06 18:27	ake	5120968	EPA 625
Benzo (a) anthracene	<10.0		ug/L	10.0	1.06	01/10/06 18:27	ake	5120968	EPA 625
Benzo (b) fluoranthene	<10.0		ug/L	10.0	1.06	01/10/06 18:27	ake	5120968	EPA 625
Benzo (k) fluoranthene	<10.0		ug/L	10.0	1.06	01/10/06 18:27	ake	5120968	EPA 625
Benzo (a) pyrene	<10.0		ug/L	10.0	1.06	01/10/06 18:27	ake	5120968	EPA 625
Benzo (g,h,i) perylene	<10.0		ug/L	10.0	1.06	01/10/06 18:27	ake	5120968	EPA 625
Butyl benzyl phthalate	<10.0		ug/L	10.0	1.06	01/10/06 18:27	ake	5120968	EPA 625
Bis(2-chloroethyl)ether	<10.0		ug/L	10.0	1.06	01/10/06 18:27	ake	5120968	EPA 625
Bis(2-chloroethoxy)methane	<10.0		ug/L	10.0	1.06	01/10/06 18:27	ake	5120968	EPA 625
Bis(2-ethylhexyl)phthalate	<10.0		ug/L	10.0	1.06	01/10/06 18:27	ake	5120968	EPA 625
Bis(2-chloroisopropyl) ether	<10.0		ug/L	10.0	1.06	01/10/06 18:27	ake	5120968	EPA 625
4-Bromophenyl phenyl ether	<10.0		ug/L	10.0	1.06	01/10/06 18:27	ake	5120968	EPA 625
Carbazole	<10.0		ug/L	10.0	1.06	01/10/06 18:27	ake	5120968	EPA 625
4-Chloroaniline	<10.0		ug/L	10.0	1.06	01/10/06 18:27	ake	5120968	EPA 625
2-Chloronaphthalene	<10.0		ug/L	10.0	1.06	01/10/06 18:27	ake	5120968	EPA 625
4-Chlorophenyl phenyl ether	<10.0		ug/L	10.0	1.06	01/10/06 18:27	ake	5120968	EPA 625
Chrysene	<10.0		ug/L	10.0	1.06	01/10/06 18:27	ake	5120968	EPA 625
Dibenzo (a,h) anthracene	<10.0		ug/L	10.0	1.06	01/10/06 18:27	ake	5120968	EPA 625
Dibenzofuran	<10.0		ug/L	10.0	1.06	01/10/06 18:27	ake	5120968	EPA 625
Di-n-butyl phthalate	<10.0		ug/L	10.0	1.06	01/10/06 18:27	ake	5120968	EPA 625
1,2-Dichlorobenzene	<10.0		ug/L	10.0	1.06	01/10/06 18:27	ake	5120968	EPA 625
1,3-Dichlorobenzene	<10.0		ug/L	10.0	1.06	01/10/06 18:27	ake	5120968	EPA 625
1,4-Dichlorobenzene	<10.0		ug/L	10.0	1.06	01/10/06 18:27	ake	5120968	EPA 625
3,3'-Dichlorobenzidine	<10.0		ug/L	10.0	1.06	01/10/06 18:27	ake	5120968	EPA 625
Diethyl phthalate	<10.0		ug/L	10.0	1.06	01/10/06 18:27	ake	5120968	EPA 625
Dimethyl phthalate	<10.0		ug/L	10.0	1.06	01/10/06 18:27	ake	5120968	EPA 625
2,4-Dinitrotoluene	<10.0		ug/L	10.0	1.06	01/10/06 18:27	ake	5120968	EPA 625
2,6-Dinitrotoluene	<10.0		ug/L	10.0	1.06	01/10/06 18:27	ake	5120968	EPA 625
Di-n-octyl phthalate	<10.0		ug/L	10.0	1.06	01/10/06 18:27	ake	5120968	EPA 625
Fluoranthene	<10.0		ug/L	10.0	1.06	01/10/06 18:27	ake	5120968	EPA 625
Fluorene	<10.0		ug/L	10.0	1.06	01/10/06 18:27	ake	5120968	EPA 625
Hexachlorobenzene	<10.0		ug/L	10.0	1.06	01/10/06 18:27	ake	5120968	EPA 625
Hexachlorobutadiene	<10.0		ug/L	10.0	1.06	01/10/06 18:27	ake	5120968	EPA 625
Hexachlorocyclopentadiene	<10.0		ug/L	10.0	1.06	01/10/06 18:27	ake	5120968	EPA 625
Hexachloroethane	<10.0		ug/L	10.0	1.06	01/10/06 18:27	ake	5120968	EPA 625
Indeno (1,2,3-cd) pyrene	<10.0		ug/L	10.0	1.06	01/10/06 18:27	ake	5120968	EPA 625
Isophorone	<10.0		ug/L	10.0	1.06	01/10/06 18:27	ake	5120968	EPA 625
2-Methylnaphthalene	<10.0		ug/L	10.0	1.06	01/10/06 18:27	ake	5120968	EPA 625
Naphthalene	<10.0		ug/L	10.0	1.06	01/10/06 18:27	ake	5120968	EPA 625
2-Nitroaniline	<10.0		ug/L	10.0	1.06	01/10/06 18:27	ake	5120968	EPA 625
3-Nitroaniline	<10.0		ug/L	10.0	1.06	01/10/06 18:27	ake	5120968	EPA 625
4-Nitroaniline	<10.0		ug/L	10.0	1.06	01/10/06 18:27	ake	5120968	EPA 625
Nitrobenzene	<10.0		ug/L	10.0	1.06	01/10/06 18:27	ake	5120968	EPA 625

TestAmerica
ANALYTICAL TESTING CORPORATION

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Work Order: COL1216
Project: Landfill Leachate Permit Renewal
Project Number: Landfill Leachate Permit Renewal

Received: 12/28/05
Reported: 01/31/06 13:48

ANALYTICAL REPORT

Analyte	Sample Result	Data Qualifiers	Units	Quan. Limit	Dilution Factor	Date Analyzed	Analyst	Seq/ Batch	Method
Sample ID: COL1216-01 (Landfill Leachate - Ground Water) - cont.					**Sampled: 12/27/05 09:20**		**Recvd: 12/28/05 08:40**		
Semivolatile Organics by GC/MS - cont.									
N-Nitrosodiphenylamine	<10.0		ug/L	10.0	1.06	01/10/06 18:27	ake	5120968	EPA 625
N-Nitrosodi-n-propylamine	<10.0		ug/L	10.0	1.06	01/10/06 18:27	ake	5120968	EPA 625
Phenanthrene	<10.0		ug/L	10.0	1.06	01/10/06 18:27	ake	5120968	EPA 625
Pyrene	<10.0		ug/L	10.0	1.06	01/10/06 18:27	ake	5120968	EPA 625
1,2,4-Trichlorobenzene	<10.0		ug/L	10.0	1.06	01/10/06 18:27	ake	5120968	EPA 625
4-Chloro-3-methylphenol	<10.0		ug/L	10.0	1.06	01/10/06 18:27	ake	5120968	EPA 625
2-Chlorophenol	<10.0		ug/L	10.0	1.06	01/10/06 18:27	ake	5120968	EPA 625
2,4-Dichlorophenol	<10.0		ug/L	10.0	1.06	01/10/06 18:27	ake	5120968	EPA 625
2,4-Dimethylphenol	<10.0		ug/L	10.0	1.06	01/10/06 18:27	ake	5120968	EPA 625
2,4-Dinitrophenol	<10.0		ug/L	10.0	1.06	01/10/06 18:27	ake	5120968	EPA 625
4,6-Dinitro-2-methylphenol	<10.0		ug/L	10.0	1.06	01/10/06 18:27	ake	5120968	EPA 625
2-Nitrophenol	<10.0		ug/L	10.0	1.06	01/10/06 18:27	ake	5120968	EPA 625
4-Nitrophenol	<10.0		ug/L	10.0	1.06	01/10/06 18:27	ake	5120968	EPA 625
Pentachlorophenol	<10.0		ug/L	10.0	1.06	01/10/06 18:27	ake	5120968	EPA 625
Phenol	<10.0		ug/L	10.0	1.06	01/10/06 18:27	ake	5120968	EPA 625
2-Methylphenol (o-Cresol)	<10.0		ug/L	10.0	1.06	01/10/06 18:27	ake	5120968	EPA 625
4-Methylphenol (p-Cresol)	<10.0		ug/L	10.0	1.06	01/10/06 18:27	ake	5120968	EPA 625
2,4,5-Trichlorophenol	<10.0		ug/L	10.0	1.06	01/10/06 18:27	ake	5120968	EPA 625
2,4,6-Trichlorophenol	<10.0		ug/L	10.0	1.06	01/10/06 18:27	ake	5120968	EPA 625
Surr: Nitrobenzene-d5 (35-110%)	*76 %*								
Surr: 2-Fluorobiphenyl (30-120%)	*71 %*								
Surr: Terphenyl-d14 (35-130%)	*81 %*								
Surr: Phenol-d6 (10-60%)	*39 %*								
Surr: 2-Fluorophenol (10-75%)	*52 %*								
Surr: 2,4,6-Tribromophenol (45-140%)	*96 %*								
VOC Preservation Check									
pH	<2.00		units	2.00	1	01/05/06 12:39	sjn	6010138	SW
Herbicides									
2,4,5-TP (Silvex)	<0.2		ug/L	0.2	1	01/19/06 00:00		xx	8151 Herbicides
2,4-D	<0.4		ug/L	0.4	1	01/19/06 00:00		xx	8151 Herbicides
Organochlorine Pesticides/PCBs									
4,4'-DDD	<0.05		ug/L	0.05	1	01/19/06 00:00		xx	608 Pesticides
4,4'-DDE	<0.05		ug/L	0.05	1	01/19/06 00:00		xx	608 Pesticides
4,4'-DDT	<0.05		ug/L	0.05	1	01/19/06 00:00		xx	608 Pesticides
Aldrin	<0.05		ug/L	0.05	1	01/19/06 00:00		xx	608 Pesticides
alpha-BHC	<0.05		ug/L	0.05	1	01/19/06 00:00		xx	608 Pesticides
beta-BHC	<0.05		ug/L	0.05	1	01/19/06 00:00		xx	608 Pesticides
delta-BHC	<0.1		ug/L	0.1	1	01/19/06 00:00		xx	608 Pesticides
Dieldrin	<0.05		ug/L	0.05	1	01/19/06 00:00		xx	608 Pesticides
Endosulfan I	<0.05		ug/L	0.05	1	01/19/06 00:00		xx	608 Pesticides
Endosulfan II	<0.05		ug/L	0.05	1	01/19/06 00:00		xx	608 Pesticides
Endosulfan sulfate	<0.05		ug/L	0.05	1	01/19/06 00:00		xx	608 Pesticides
Endrin	<0.05		ug/L	0.05	1	01/19/06 00:00		xx	608 Pesticides
Endrin aldehyde	<0.05		ug/L	0.05	1	01/19/06 00:00		xx	608 Pesticides

TestAmerica Analytical - Cedar Falls
Derrick Klinkenberg
Organics Manager

FANSTEEL/WELLMAN CORP.
1746 Commerce Road
Creston, IA 50801
Joe Haller

Work Order: COL1216
Project: Landfill Leachate Permit Renewal
Project Number: Landfill Leachate Permit Renewal

Received: 12/28/05
Reported: 01/31/06 13:48

ANALYTICAL REPORT

Analyte	Sample Result	Data Qualifiers	Units	Quan. Limit	Dilution Factor	Date Analyzed	Analyst	Seq/ Batch	Method
Sample ID: COL1216-01 (Landfill Leachate - Ground Water) - cont.					**Sampled: 12/27/05 09:20**		**Recvd: 12/28/05 08:40**		
Organochlorine Pesticides/PCBs - cont.									
gamma-BHC (Lindane)	<0.05		ug/L	0.05	1	01/19/06 00:00		xx	608 Pesticides
Heptachlor	<0.05		ug/L	0.05	1	01/19/06 00:00		xx	608 Pesticides
Heptachlor epoxide	<0.05		ug/L	0.05	1	01/19/06 00:00		xx	608 Pesticides
Methoxychlor	<0.05		ug/L	0.05	1	01/19/06 00:00		xx	608 Pesticides

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SAMPLE EXTRACTION DATA

Parameter	Batch	Lab Number	Wt/Vol Extracted	Extracted Vol	Date	Analyst	Extraction Method
Semivolatile Organics by GC/MS							
EPA 625	5120968	COL1216-01	940	1	12/29/05 14:02	MDM	SW 3510C_MS

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LABORATORY BLANK QC DATA

Analyte	Seq/ Batch	Source Result	Spike Level	Units	MDL	MRL	Result	Dup Result	% REC	Dup %REC	% REC Limits	RPD	RPD Limit	Q
General Chemistry Parameters														
BOD - 5 Day	5120888			mg/L	N/A	3.00	<3.00							
Nitrate as N	5120914			mg/L	N/A	1.00	<1.00							
Total Kjeldahl Nitrogen	5120937			mg/L	N/A	1.00	<1.00							
Total Suspended Solids	5120951			mg/L	N/A	3.00	<3.00							
Chemical Oxygen Demand	5120970			mg/L	N/A	25.0	<25.0							
Oil & Grease	5120982			mg/L	N/A	4.00	<4.00							
Ammonia as N	5120985			mg/L	N/A	0.500	<0.500							
Total Dissolved Solids	6010003			mg/L	N/A	20.0	<20.0							
Phosphorus, Total (as P)	6010010			mg/L	N/A	0.100	<0.100							
Chloride	6010017			mg/L	N/A	5.00	<5.00							
Total Organic Carbon	6010057			mg/L	N/A	1.00	<1.00							
Total Volatile Solids	6010060			mg/L	N/A	20.0	<20.0							
Total Solids	6010062			mg/L	N/A	20.0	<20.0							
Sulfate	6010255			mg/L	N/A	10.0	<10.0							
Fluoride	6010305			mg/L	N/A	1.00	<1.00							
Total Metals by EPA 200 Series Methods														
Aluminum	5120994			mg/L	N/A	0.100	<0.100							
Arsenic	5120994			mg/L	N/A	0.0800	<0.0800							
Barium	5120994			mg/L	N/A	0.0100	<0.0100							
Cadmium	5120994			mg/L	N/A	0.0200	<0.0200							
Chromium	5120994			mg/L	N/A	0.0200	<0.0200							
Copper	5120994			mg/L	N/A	0.0200	<0.0200							
Iron	5120994			mg/L	N/A	0.100	<0.100							
Lead	5120994			mg/L	N/A	0.100	<0.100							
Manganese	5120994			mg/L	N/A	0.0100	<0.0100							
Nickel	5120994			mg/L	N/A	0.0500	<0.0500							
Potassium	5120994			mg/L	N/A	1.00	<1.00							
Selenium	5120994			mg/L	N/A	0.150	<0.150							
Silver	5120994			mg/L	N/A	0.0200	<0.0200							
Zinc	5120994			mg/L	N/A	0.0200	<0.0200							
Magnesium	5120994			mg/L	N/A	1.00	<1.00							

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Project Number: Landfill Leachate Permit Renewal

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LABORATORY BLANK QC DATA

Analyte	Seq/ Batch	Source Result	Spike Level	Units	MDL	MRL	Result	Dup Result	% REC	Dup %REC	% REC Limits	RPD	RPD Limit	Q
Total Metals by EPA 200 Series Methods														
Mercury	6010059			mg/L	N/A	0.000200	<0.000200							
Volatile Organic Compounds														
Acetone	6010055			ug/L	N/A	10.0	<10.0							
Benzene	6010055			ug/L	N/A	0.500	<0.500							
Bromodichloromethane	6010055			ug/L	N/A	1.00	<1.00							
Bromoform	6010055			ug/L	N/A	5.00	<5.00							
Bromomethane	6010055			ug/L	N/A	4.00	<4.00							
Carbon Tetrachloride	6010055			ug/L	N/A	2.00	<2.00							
Chlorobenzene	6010055			ug/L	N/A	1.00	<1.00							
Chloroethane	6010055			ug/L	N/A	4.00	<4.00							
Chloroform	6010055			ug/L	N/A	1.00	<1.00							
Chloromethane	6010055			ug/L	N/A	3.00	<3.00							CIN
Bromochloromethane	6010055			ug/L	N/A	5.00	<5.00							
1,2,3-Trichloropropane	6010055			ug/L	N/A	1.00	<1.00							
Chlorodibromomethane	6010055			ug/L	N/A	5.00	<5.00							
1,2-Dibromoethane (EDB)	6010055			ug/L	N/A	10.0	<10.0							
m,p-Xylene	6010055			ug/L	N/A	2.00	<2.00							
o-Xylene	6010055			ug/L	N/A	1.00	<1.00							
1,2-Dichlorobenzene	6010055			ug/L	N/A	1.00	<1.00							
1,3-Dichlorobenzene	6010055			ug/L	N/A	1.00	<1.00							
1,4-Dichlorobenzene	6010055			ug/L	N/A	1.00	<1.00							
Dichlorodifluoromethane	6010055			ug/L	N/A	3.00	<3.00							
1,1-Dichloroethane	6010055			ug/L	N/A	1.00	<1.00							
1,2-Dichloroethane	6010055			ug/L	N/A	1.00	<1.00							
1,1-Dichloroethene	6010055			ug/L	N/A	2.00	<2.00							
cis-1,2-Dichloroethene	6010055			ug/L	N/A	1.00	<1.00							
trans-1,2-Dichloroethene	6010055			ug/L	N/A	1.00	<1.00							
1,2-Dichloropropane	6010055			ug/L	N/A	1.00	<1.00							
cis-1,3-Dichloropropene	6010055			ug/L	N/A	5.00	<5.00							
trans-1,3-Dichloropropene	6010055			ug/L	N/A	5.00	<5.00							
1,3-Dichloropropene (total)	6010055			ug/L	N/A	5.00	<5.00							
Ethylbenzene	6010055			ug/L	N/A	1.00	<1.00							
2-Hexanone	6010055			ug/L	N/A	10.0	<10.0							
2-Butanone (MEK)	6010055			ug/L	N/A	10.0	<10.0							
4-Methyl-2-pentanone (MIBK)	6010055			ug/L	N/A	10.0	<10.0							
Methylene Chloride	6010055			ug/L	N/A	5.00	<5.00							
Styrene	6010055			ug/L	N/A	1.00	<1.00							
1,1,1,2-Tetrachloroethane	6010055			ug/L	N/A	1.00	<1.00							
1,1,2,2-Tetrachloroethane	6010055			ug/L	N/A	1.00	<1.00							
Tetrachloroethene	6010055			ug/L	N/A	1.00	<1.00							
Trichloroethene	6010055			ug/L	N/A	1.00	<1.00							
1,1,2-Trichloroethane	6010055			ug/L	N/A	1.00	<1.00							
1,1,1-Trichloroethane	6010055			ug/L	N/A	1.00	<1.00							
Vinyl chloride	6010055			ug/L	N/A	1.00	<1.00							

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Derrick Klinkenberg
Organics Manager

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FANSTEEL/WELLMAN CORP.
1746 Commerce Road
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Joe Haller

Work Order: COL1216
Project: Landfill Leachate Permit Renewal
Project Number: Landfill Leachate Permit Renewal

Received: 12/28/05
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LABORATORY BLANK QC DATA

Analyte	Seq/ Batch	Source Result	Spike Level	Units	MDL	MRL	Result	Dup Result	% REC	Dup %REC	% REC Limits	RPD	RPD Limit	Q
Volatile Organic Compounds														
Xylenes, total	6010055			ug/L	N/A	2.00	<2.00							
Surrogate: Dibromofluoromethane	*6010055*			ug/L					*101*		*70-130*			
Surrogate: Toluene-d8	*6010055*			ug/L					*100*		*70-130*			
Surrogate: 4-Bromofluorobenzene	*6010055*			ug/L					*88*		*70-130*			
Semivolatile Organics by GC/MS														
Acenaphthene	5120968			ug/L	N/A	10.0	<10.0							
Acenaphthylene	5120968			ug/L	N/A	10.0	<10.0							
Anthracene	5120968			ug/L	N/A	10.0	<10.0							
Benzo (a) anthracene	5120968			ug/L	N/A	10.0	<10.0							
Benzo (b) fluoranthene	5120968			ug/L	N/A	10.0	<10.0							
Benzo (k) fluoranthene	5120968			ug/L	N/A	10.0	<10.0							
Benzo (a) pyrene	5120968			ug/L	N/A	10.0	<10.0							
Benzo (g,h,i) perylene	5120968			ug/L	N/A	10.0	<10.0							
Butyl benzyl phthalate	5120968			ug/L	N/A	10.0	<10.0							
Bis(2-chloroethyl)ether	5120968			ug/L	N/A	10.0	<10.0							
Bis(2-chloroethoxy)methane	5120968			ug/L	N/A	10.0	<10.0							
Bis(2-ethylhexyl)phthalate	5120968			ug/L	N/A	10.0	<10.0							
Bis(2-chloroisopropyl) ether	5120968			ug/L	N/A	10.0	<10.0							
4-Bromophenyl phenyl ether	5120968			ug/L	N/A	10.0	<10.0							
Carbazole	5120968			ug/L	N/A	10.0	<10.0							
4-Chloroaniline	5120968			ug/L	N/A	10.0	<10.0							
2-Chloronaphthalene	5120968			ug/L	N/A	10.0	<10.0							
4-Chlorophenyl phenyl ether	5120968			ug/L	N/A	10.0	<10.0							
Chrysene	5120968			ug/L	N/A	10.0	<10.0							
Dibenzo (a,h) anthracene	5120968			ug/L	N/A	10.0	<10.0							
Dibenzofuran	5120968			ug/L	N/A	10.0	<10.0							
Di-n-butyl phthalate	5120968			ug/L	N/A	10.0	<10.0							
1,2-Dichlorobenzene	5120968			ug/L	N/A	10.0	<10.0							
1,3-Dichlorobenzene	5120968			ug/L	N/A	10.0	<10.0							
1,4-Dichlorobenzene	5120968			ug/L	N/A	10.0	<10.0							
3,3'-Dichlorobenzidine	5120968			ug/L	N/A	10.0	<10.0							
Diethyl phthalate	5120968			ug/L	N/A	10.0	<10.0							
Dimethyl phthalate	5120968			ug/L	N/A	10.0	<10.0							
2,4-Dinitrotoluene	5120968			ug/L	N/A	10.0	<10.0							
2,6-Dinitrotoluene	5120968			ug/L	N/A	10.0	<10.0							
Di-n-octyl phthalate	5120968			ug/L	N/A	10.0	<10.0							
Fluoranthene	5120968			ug/L	N/A	10.0	<10.0							
Fluorene	5120968			ug/L	N/A	10.0	<10.0							
Hexachlorobenzene	5120968			ug/L	N/A	10.0	<10.0							
Hexachlorobutadiene	5120968			ug/L	N/A	10.0	<10.0							
Hexachlorocyclopentadiene	5120968			ug/L	N/A	10.0	<10.0							
Hexachloroethane	5120968			ug/L	N/A	10.0	<10.0							
Indeno (1,2,3-cd) pyrene	5120968			ug/L	N/A	10.0	<10.0							
Isophorone	5120968			ug/L	N/A	10.0	<10.0							

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LABORATORY BLANK QC DATA

Analyte	Seq/ Batch	Source Result	Spike Level	Units	MDL	MRL	Result	Dup Result	% REC	Dup %REC	% REC Limits	RPD	RPD Limit	Q
Semivolatile Organics by GC/MS														
2-Methylnaphthalene	5120968			ug/L	N/A	10.0	<10.0							
Naphthalene	5120968			ug/L	N/A	10.0	<10.0							
2-Nitroaniline	5120968			ug/L	N/A	10.0	<10.0							
3-Nitroaniline	5120968			ug/L	N/A	10.0	<10.0							
4-Nitroaniline	5120968			ug/L	N/A	10.0	<10.0							
Nitrobenzene	5120968			ug/L	N/A	10.0	<10.0							
N-Nitrosodiphenylamine	5120968			ug/L	N/A	10.0	<10.0							
N-Nitrosodi-n-propylamine	5120968			ug/L	N/A	10.0	<10.0							
Phenanthrene	5120968			ug/L	N/A	10.0	<10.0							
Pyrene	5120968			ug/L	N/A	10.0	<10.0							
1,2,4-Trichlorobenzene	5120968			ug/L	N/A	10.0	<10.0							
4-Chloro-3-methylphenol	5120968			ug/L	N/A	10.0	<10.0							
2-Chlorophenol	5120968			ug/L	N/A	10.0	<10.0							
2,4-Dichlorophenol	5120968			ug/L	N/A	10.0	<10.0							
2,4-Dimethylphenol	5120968			ug/L	N/A	10.0	<10.0							
2,4-Dinitrophenol	5120968			ug/L	N/A	10.0	<10.0							
4,6-Dinitro-2-methylphenol	5120968			ug/L	N/A	10.0	<10.0							
2-Nitrophenol	5120968			ug/L	N/A	10.0	<10.0							
4-Nitrophenol	5120968			ug/L	N/A	10.0	<10.0							
Pentachlorophenol	5120968			ug/L	N/A	10.0	<10.0							
Phenol	5120968			ug/L	N/A	10.0	<10.0							
2-Methylphenol (o-Cresol)	5120968			ug/L	N/A	10.0	<10.0							
4-Methylphenol (p-Cresol)	5120968			ug/L	N/A	10.0	<10.0							
2,4,5-Trichlorophenol	5120968			ug/L	N/A	10.0	<10.0							
2,4,6-Trichlorophenol	5120968			ug/L	N/A	10.0	<10.0							
Surrogate: Nitrobenzene-d5	*5120968*			ug/L					*78*		*35-110*			
Surrogate: 2-Fluorobiphenyl	*5120968*			ug/L					*67*		*30-120*			
Surrogate: Terphenyl-d14	*5120968*			ug/L					*96*		*35-130*			
Surrogate: Phenol-d6	*5120968*			ug/L					*31*		*10-60*			
Surrogate: 2-Fluorophenol	*5120968*			ug/L					*51*		*10-75*			
Surrogate: 2,4,6-Tribromophenol	*5120968*			ug/L					*94*		*45-140*			

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Reported: 01/31/06 13:48

CCV QC DATA

Analyte	Seq/ Batch	Source Result	Spike Level	Units	MDL	MRL	Result	Dup Result	% REC	Dup %REC	% REC Limits	RPD	RPD Limit	Q
Volatile Organic Compounds														
Acetone	6010055		100	ug/L	N/A	N/A	100		100		50-150			
Benzene	6010055		100	ug/L	N/A	N/A	98.3		98		80-120			
Bromodichloromethane	6010055		100	ug/L	N/A	N/A	103		103		80-120			
Bromoform	6010055		100	ug/L	N/A	N/A	110		110		80-120			
Bromomethane	6010055		100	ug/L	N/A	N/A	140		140		50-150			
Carbon Tetrachloride	6010055		100	ug/L	N/A	N/A	103		103		80-120			
Chlorobenzene	6010055		100	ug/L	N/A	N/A	105		105		80-120			
Chloroethane	6010055		100	ug/L	N/A	N/A	106		106		80-120			
Chloroform	6010055		100	ug/L	N/A	N/A	95.0		95		80-120			
Chloromethane	6010055		100	ug/L	N/A	N/A	124		124		50-150			CIN
Bromochloromethane	6010055		100	ug/L	N/A	N/A	115		115		80-120			
1,2,3-Trichloropropane	6010055		100	ug/L	N/A	N/A	94.2		94		80-120			
Chlorodibromomethane	6010055		100	ug/L	N/A	N/A	111		111		80-120			
1,2-Dibromoethane (EDB)	6010055		100	ug/L	N/A	N/A	97.1		97		80-120			
m,p-Xylene	6010055		200	ug/L	N/A	N/A	215		108		80-120			
o-Xylene	6010055		100	ug/L	N/A	N/A	107		107		80-120			
1,2-Dichlorobenzene	6010055		100	ug/L	N/A	N/A	110		110		80-120			
1,3-Dichlorobenzene	6010055		100	ug/L	N/A	N/A	107		107		80-120			
1,4-Dichlorobenzene	6010055		100	ug/L	N/A	N/A	106		106		80-120			
Dichlorodifluoromethane	6010055		100	ug/L	N/A	N/A	90.4		90		80-120			
1,1-Dichloroethane	6010055		100	ug/L	N/A	N/A	97.8		98		80-120			
1,2-Dichloroethane	6010055		100	ug/L	N/A	N/A	106		106		80-120			
1,1-Dichloroethene	6010055		100	ug/L	N/A	N/A	100		100		80-120			
cis-1,2-Dichloroethene	6010055		100	ug/L	N/A	N/A	102		102		80-120			
trans-1,2-Dichloroethene	6010055		100	ug/L	N/A	N/A	101		101		80-120			
1,2-Dichloropropane	6010055		100	ug/L	N/A	N/A	98.2		98		80-120			
cis-1,3-Dichloropropene	6010055		100	ug/L	N/A	N/A	93.8		94		50-150			
trans-1,3-Dichloropropene	6010055		100	ug/L	N/A	N/A	95.5		96		50-150			
1,3-Dichloropropene (total)	6010055		200	ug/L	N/A	N/A	189		94		80-120			
Ethylbenzene	6010055		100	ug/L	N/A	N/A	102		102		80-120			
2-Hexanone	6010055		100	ug/L	N/A	N/A	119		119		50-150			
2-Butanone (MEK)	6010055		100	ug/L	N/A	N/A	99.3		99		50-150			
4-Methyl-2-pentanone (MIBK)	6010055		100	ug/L	N/A	N/A	112		112		50-150			
Methylene Chloride	6010055		100	ug/L	N/A	N/A	93.2		93		50-150			
Styrene	6010055		100	ug/L	N/A	N/A	109		109		80-120			
1,1,1,2-Tetrachloroethane	6010055		100	ug/L	N/A	N/A	109		109		80-120			
1,1,2,2-Tetrachloroethane	6010055		100	ug/L	N/A	N/A	119		119		80-120			
Tetrachloroethene	6010055		100	ug/L	N/A	N/A	103		103		80-120			
Trichloroethene	6010055		100	ug/L	N/A	N/A	99.2		99		80-120			
1,1,2-Trichloroethane	6010055		100	ug/L	N/A	N/A	104		104		80-120			
1,1,1-Trichloroethane	6010055		100	ug/L	N/A	N/A	99.7		100		80-120			
Vinyl chloride	6010055		100	ug/L	N/A	N/A	97.6		98		80-120			
Xylenes, total	6010055		300	ug/L	N/A	N/A	322		107		80-120			
Surrogate: Dibromofluoromethane	*6010055*			ug/L					*101*		*80-120*			
Surrogate: Toluene-d8	*6010055*			ug/L					*105*		*80-120*			

TestAmerica Analytical - Cedar Falls
Derrick Klinkenberg
Organics Manager

TestAmerica

ANALYTICAL TESTING CORPORATION

704 Enterprise Drive Cedar Falls, IA 50613 * 800-750-2401 * Fax 319-277-2425

FANSTEEL/WELLMAN CORP.
1746 Commerce Road
Creston, IA 50801
Joe Haller

Work Order: COL1216
Project: Landfill Leachate Permit Renewal
Project Number: Landfill Leachate Permit Renewal

Received: 12/28/05
Reported: 01/31/06 13:48

CCV QC DATA

Analyte	Seq/ Batch	Source Result	Spike Level	Units	MDL	MRL	Result	Dup Result	% REC	Dup %REC	% REC Limits	RPD	RPD Limit	Q
Volatile Organic Compounds														
Surrogate: 4-Bromofluorobenzene	*6010055*			ug/L					*102*		*80-120*			
Semivolatile Organics by GC/MS														
Acenaphthene	6A11001		50.0	ug/L	N/A	N/A	50.4		101		80-120			
Acenaphthylene	6A11001		50.0	ug/L	N/A	N/A	50.8		102		80-120			
Anthracene	6A11001		50.0	ug/L	N/A	N/A	51.0		102		80-120			
Benzo (a) anthracene	6A11001		50.0	ug/L	N/A	N/A	51.3		103		80-120			
Benzo (b) fluoranthene	6A11001		50.0	ug/L	N/A	N/A	51.6		103		80-120			
Benzo (k) fluoranthene	6A11001		50.0	ug/L	N/A	N/A	50.4		101		80-120			
Benzo (a) pyrene	6A11001		50.0	ug/L	N/A	N/A	51.3		103		80-120			
Benzo (g,h,i) perylene	6A11001		50.0	ug/L	N/A	N/A	48.2		96		80-120			
Butyl benzyl phthalate	6A11001		50.0	ug/L	N/A	N/A	58.7		117		80-120			
Bis(2-chloroethyl)ether	6A11001		50.0	ug/L	N/A	N/A	50.0		100		80-120			
Bis(2-chloroethoxy)methane	6A11001		50.0	ug/L	N/A	N/A	52.1		104		80-120			
Bis(2-ethylhexyl)phthalate	6A11001		50.0	ug/L	N/A	N/A	59.1		118		80-120			
Bis(2-chloroisopropyl) ether	6A11001		50.0	ug/L	N/A	N/A	51.4		103		80-120			
Carbazole	6A11001		50.0	ug/L	N/A	N/A	50.6		101		80-120			
4-Chloroaniline	6A11001		50.0	ug/L	N/A	N/A	51.2		102		80-120			
2-Chloronaphthalene	6A11001		50.0	ug/L	N/A	N/A	51.1		102		80-120			
4-Chlorophenyl phenyl ether	6A11001		50.0	ug/L	N/A	N/A	50.8		102		80-120			
Chrysene	6A11001		50.0	ug/L	N/A	N/A	50.9		102		80-120			
Dibenzo (a,h) anthracene	6A11001		50.0	ug/L	N/A	N/A	48.6		97		80-120			
Dibenzofuran	6A11001		50.0	ug/L	N/A	N/A	50.0		100		80-120			
Di-n-butyl phthalate	6A11001		50.0	ug/L	N/A	N/A	54.9		110		80-120			
1,2-Dichlorobenzene	6A11001		50.0	ug/L	N/A	N/A	50.2		100		80-120			
1,3-Dichlorobenzene	6A11001		50.0	ug/L	N/A	N/A	50.3		101		80-120			
1,4-Dichlorobenzene	6A11001		50.0	ug/L	N/A	N/A	49.4		99		80-120			
3,3'-Dichlorobenzidine	6A11001		50.0	ug/L	N/A	N/A	53.6		107		80-120			
Diethyl phthalate	6A11001		50.0	ug/L	N/A	N/A	51.9		104		80-120			
Dimethyl phthalate	6A11001		50.0	ug/L	N/A	N/A	51.1		102		80-120			
2,4-Dinitrotoluene	6A11001		50.0	ug/L	N/A	N/A	51.6		103		80-120			
2,6-Dinitrotoluene	6A11001		50.0	ug/L	N/A	N/A	53.4		107		80-120			
Di-n-octyl phthalate	6A11001		50.0	ug/L	N/A	N/A	66.1		132		80-120			C
Fluoranthene	6A11001		50.0	ug/L	N/A	N/A	49.7		99		80-120			
Fluorene	6A11001		50.0	ug/L	N/A	N/A	50.2		100		80-120			
Hexachlorobenzene	6A11001		50.0	ug/L	N/A	N/A	51.9		104		80-120			
Hexachlorobutadiene	6A11001		50.0	ug/L	N/A	N/A	50.9		102		80-120			
Hexachlorocyclopentadiene	6A11001		50.0	ug/L	N/A	N/A	54.8		110		80-120			
Hexachloroethane	6A11001		50.0	ug/L	N/A	N/A	51.0		102		80-120			
Indeno (1,2,3-cd) pyrene	6A11001		50.0	ug/L	N/A	N/A	49.8		100		80-120			
Isophorone	6A11001		50.0	ug/L	N/A	N/A	52.7		105		80-120			
2-Methylnaphthalene	6A11001		50.0	ug/L	N/A	N/A	50.8		102		80-120			
Naphthalene	6A11001		50.0	ug/L	N/A	N/A	50.2		100		80-120			
2-Nitroaniline	6A11001		50.0	ug/L	N/A	N/A	52.0		104		80-120			
3-Nitroaniline	6A11001		50.0	ug/L	N/A	N/A	51.4		103		80-120			

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Joe Haller

Work Order: COL1216
Project: Landfill Leachate Permit Renewal
Project Number: Landfill Leachate Permit Renewal

Received: 12/28/05
Reported: 01/31/06 13:48

CCV QC DATA

Analyte	Seq/ Batch	Source Result	Spike Level	Units	MDL	MRL	Result	Dup Result	% REC	Dup %REC	% REC Limits	RPD	RPD Limit	Q
Semivolatile Organics by GC/MS														
4-Nitroaniline	6A11001		50.0	ug/L	N/A	N/A	50.3		101		80-120			
Nitrobenzene	6A11001		50.0	ug/L	N/A	N/A	51.2		102		80-120			
N-Nitrosodiphenylamine	6A11001		50.0	ug/L	N/A	N/A	51.8		104		80-120			
N-Nitrosodi-n-propylamine	6A11001		50.0	ug/L	N/A	N/A	50.3		101		80-120			
Phenanthrene	6A11001		50.0	ug/L	N/A	N/A	50.5		101		80-120			
Pyrene	6A11001		50.0	ug/L	N/A	N/A	54.8		110		80-120			
1,2,4-Trichlorobenzene	6A11001		50.0	ug/L	N/A	N/A	50.8		102		80-120			
4-Chloro-3-methylphenol	6A11001		50.0	ug/L	N/A	N/A	51.3		103		80-120			
2-Chlorophenol	6A11001		50.0	ug/L	N/A	N/A	49.9		100		80-120			
2,4-Dichlorophenol	6A11001		50.0	ug/L	N/A	N/A	51.7		103		80-120			
2,4-Dimethylphenol	6A11001		50.0	ug/L	N/A	N/A	51.6		103		80-120			
2,4-Dinitrophenol	6A11001		50.0	ug/L	N/A	N/A	47.9		96		80-120			
4,6-Dinitro-2-methylphenol	6A11001		50.0	ug/L	N/A	N/A	52.9		106		80-120			
2-Nitrophenol	6A11001		50.0	ug/L	N/A	N/A	53.7		107		80-120			
4-Nitrophenol	6A11001		50.0	ug/L	N/A	N/A	50.8		102		80-120			
Pentachlorophenol	6A11001		50.0	ug/L	N/A	N/A	52.1		104		80-120			
Phenol	6A11001		50.0	ug/L	N/A	N/A	49.1		98		80-120			
2-Methylphenol (o-Cresol)	6A11001		50.0	ug/L	N/A	N/A	50.0		100		80-120			
4-Methylphenol (p-Cresol)	6A11001		50.0	ug/L	N/A	N/A	49.9		100		80-120			
2,4,5-Trichlorophenol	6A11001		50.0	ug/L	N/A	N/A	52.5		105		80-120			
2,4,6-Trichlorophenol	6A11001		50.0	ug/L	N/A	N/A	52.7		105		80-120			
Surrogate: Nitrobenzene-d5	*6A11001*			ug/L					*105*		*80-110*			
Surrogate: 2-Fluorobiphenyl	*6A11001*			ug/L					*102*		*80-120*			
Surrogate: Terphenyl-d14	*6A11001*			ug/L					*111*		*80-120*			
Surrogate: Phenol-d6	*6A11001*			ug/L					*99*		*80-120*			
Surrogate: 2-Fluorophenol	*6A11001*			ug/L					*99*		*80-120*			
Surrogate: 2,4,6-Tribromophenol	*6A11001*			ug/L					*103*		*80-120*			

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LABORATORY DUPLICATE QC DATA

Analyte	Seq/ Batch	Source Result	Spike Level	Units	MDL	MRL	Result	% REC	Dup %REC	% REC Limits	RPD	RPD Limit	Q
General Chemistry Parameters													
QC Source Sample: COL1204-02													
BOD - 5 Day	5120888	60.0		mg/L	N/A	3.00	61.0				2	20	
QC Source Sample: COL1204-01													
pH	5120896	8.1		pH Units	N/A	0.1	8.1				0	10	
QC Source Sample: COL1207-03													
Total Suspended Solids	5120951	60.0		mg/L	N/A	3.00	74.0				21	20	R
QC Source Sample: COL1248-04													
Total Suspended Solids	5120951	3030		mg/L	N/A	3.00	2900				4	20	
QC Source Sample: COL1214-01													
Oil & Grease	5120982	1.79		mg/L	N/A	5.00	1.47				20	20	
QC Source Sample: COL1216-01													
Total Dissolved Solids	6010003	7720		mg/L	N/A	20.0	7680				1	15	
QC Source Sample: COL1216-01													
Total Volatile Solids	6010060	2960		mg/L	N/A	20.0	2880				3	20	
QC Source Sample: COL1216-01													
Total Solids	6010062	9140		mg/L	N/A	20.0	9080				1	15	

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Work Order: COL1216
Project: Landfill Leachate Permit Renewal
Project Number: Landfill Leachate Permit Renewal

Received: 12/28/05
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LCS/LCS DUPLICATE QC DATA

Analyte	Seq/ Batch	Source Result	Spike Level	Units	MDL	MRL	Result	Dup Result	% REC	Dup %REC	% REC Limits	RPD	RPD Limit	Q
General Chemistry Parameters														
BOD - 5 Day	5120888		198	mg/L	N/A	N/A	205		104		85-115			
pH	5120896		7.00	pH Units	N/A	N/A	7.0		100		98-102			
Nitrate as N	5120914		1.10	mg/L	N/A	0.250	1.15		105		90-110			
Total Kjeldahl Nitrogen	5120937		4.00	mg/L	N/A	1.00	4.12		103		90-110			
Total Suspended Solids	5120951		100	mg/L	N/A	N/A	106		106		80-110			
Alkalinity, Total (CaCO3)	5120954		44.4	mg/L	N/A	N/A	44.6		100		90-110			
Chemical Oxygen Demand	5120970		250	mg/L	N/A	N/A	254		102		80-120			
Oil & Grease	5120982		42.1	mg/L	N/A	N/A	38.2		91		78-114			
Ammonia as N	5120985		3.33	mg/L	N/A	0.500	3.28		98		90-115			
Total Dissolved Solids	6010003		1000	mg/L	N/A	N/A	1010		101		90-110			
Phosphorus, Total (as P)	6010010		3.39	mg/L	N/A	0.100	3.40		100		90-110			
Chloride	6010017		95.7	mg/L	N/A	5.00	101		106		90-110			
Total Organic Carbon	6010057		19.5	mg/L	N/A	2.00	20.5		105		80-120			
Total Solids	6010062		1000	mg/L	N/A	N/A	1010		101		90-110			
Sulfate	6010255		12.3	mg/L	N/A	10.0	11.6		94		80-120			
Fluoride	6010305		15.0	mg/L	N/A	1.00	14.4		96		80-115			
Total Metals by EPA 200 Series Methods														
Aluminum	5120994		2.00	mg/L	N/A	0.100	1.97		98		85-110			
Arsenic	5120994		2.00	mg/L	N/A	0.0800	1.96		98		85-115			
Barium	5120994		1.00	mg/L	N/A	0.0100	0.950		95		85-115			
Cadmium	5120994		1.00	mg/L	N/A	0.0200	0.972		97		85-110			
Chromium	5120994		1.00	mg/L	N/A	0.0200	0.980		98		85-110			
Copper	5120994		2.00	mg/L	N/A	0.0200	1.96		98		85-110			
Lead	5120994		2.00	mg/L	N/A	0.100	1.98		99		85-110			
Manganese	5120994		1.00	mg/L	N/A	0.0100	0.965		96		85-110			
Nickel	5120994		2.00	mg/L	N/A	0.0500	1.91		96		85-110			
Potassium	5120994		4.00	mg/L	N/A	1.00	4.05		101		85-115			
Selenium	5120994		4.00	mg/L	N/A	0.150	3.90		98		85-110			
Zinc	5120994		1.00	mg/L	N/A	0.0200	0.976		98		85-110			
Magnesium	5120994		2.00	mg/L	N/A	1.00	1.97		98		85-115			

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LCS/LCS DUPLICATE QC DATA

Analyte	Seq/ Batch	Source Result	Spike Level	Units	MDL	MRL	Result	Dup Result	% REC	Dup %REC	% REC Limits	RPD	RPD Limit	Q
Total Metals by EPA 200 Series Methods														
Silver	5120994		1.00	mg/L	N/A	0.0200	0.971		97		85-105			
Mercury	6010059		0.00167	mg/L	N/A	0.000200	0.00164		98		80-120			
Volatile Organic Compounds														
Acetone	6010055		20.0	ug/L	N/A	N/A	31.4		157		40-135			L
Benzene	6010055		20.0	ug/L	N/A	N/A	19.8		99		70-135			
Bromomethane	6010055		20.0	ug/L	N/A	N/A	21.6		108		30-125			
Carbon Tetrachloride	6010055		20.0	ug/L	N/A	N/A	20.2		101		50-135			
Chlorobenzene	6010055		20.0	ug/L	N/A	N/A	21.1		106		65-130			
Chloroform	6010055		20.0	ug/L	N/A	N/A	19.4		97		70-130			
Bromochloromethane	6010055		20.0	ug/L	N/A	N/A	22.8		114		65-130			
1,2,3-Trichloropropane	6010055		20.0	ug/L	N/A	N/A	19.7		98		55-125			
1,4-Dichlorobenzene	6010055		20.0	ug/L	N/A	N/A	20.6		103		65-130			
1,2-Dichloroethane	6010055		20.0	ug/L	N/A	N/A	21.9		110		65-135			
1,1-Dichloroethene	6010055		20.0	ug/L	N/A	N/A	19.6		98		70-135			
Ethylbenzene	6010055		20.0	ug/L	N/A	N/A	18.6		93		65-130			
Methylene Chloride	6010055		20.0	ug/L	N/A	N/A	20.0		100		70-135			
Tetrachloroethene	6010055		20.0	ug/L	N/A	N/A	20.9		104		70-130			
Trichloroethene	6010055		20.0	ug/L	N/A	N/A	19.5		98		65-130			
1,1,2-Trichloroethane	6010055		20.0	ug/L	N/A	N/A	20.5		102		65-130			
1,1,1-Trichloroethane	6010055		20.0	ug/L	N/A	N/A	19.4		97		60-135			
Vinyl chloride	6010055		20.0	ug/L	N/A	N/A	18.8		94		60-135			
Xylenes, total	6010055		60.0	ug/L	N/A	N/A	64.3		107		70-135			
Surrogate: Dibromofluoromethane	*6010055*			ug/L					*102*		*70-130*			
Surrogate: Toluene-d8	*6010055*			ug/L					*106*		*70-130*			
Surrogate: 4-Bromofluorobenzene	*6010055*			ug/L					*100*		*70-130*			
Semivolatile Organics by GC/MS														
Acenaphthene	5120968		100	ug/L	N/A	10.0	75.2		75		35-120			
Acenaphthylene	5120968		100	ug/L	N/A	10.0	70.4		70		30-115			
Anthracene	5120968		100	ug/L	N/A	10.0	79.6		80		35-125			
Benzo (a) anthracene	5120968		100	ug/L	N/A	10.0	84.3		84		40-130			
Benzo (b) fluoranthene	5120968		100	ug/L	N/A	10.0	82.9		83		40-135			
Benzo (k) fluoranthene	5120968		100	ug/L	N/A	10.0	81.4		81		40-130			
Benzo (a) pyrene	5120968		100	ug/L	N/A	10.0	82.2		82		40-130			
Benzo (g,h,i) perylene	5120968		100	ug/L	N/A	10.0	78.5		78		40-135			
Chrysene	5120968		100	ug/L	N/A	10.0	83.1		83		40-130			
Dibenzo (a,h) anthracene	5120968		100	ug/L	N/A	10.0	82.6		83		40-135			
1,4-Dichlorobenzene	5120968		100	ug/L	N/A	10.0	70.2		70		30-90			
2,4-Dinitrotoluene	5120968		100	ug/L	N/A	10.0	81.8		82		45-120			
Fluoranthene	5120968		100	ug/L	N/A	10.0	78.6		79		40-130			
Fluorene	5120968		100	ug/L	N/A	10.0	77.3		77		40-125			
Indeno (1,2,3-cd) pyrene	5120968		100	ug/L	N/A	10.0	82.1		82		40-135			
2-Methylnaphthalene	5120968		100	ug/L	N/A	10.0	71.1		71		35-100			
Naphthalene	5120968		100	ug/L	N/A	10.0	69.2		69		30-100			

TestAmerica Analytical - Cedar Falls
Derrick Klinkenberg
Organics Manager

FANSTEEL/WELLMAN CORP.
1746 Commerce Road
Creston, IA 50801
Joe Haller

Work Order: COL1216
Project: Landfill Leachate Permit Renewal
Project Number: Landfill Leachate Permit Renewal

Received: 12/28/05
Reported: 01/31/06 13:48

LCS/LCS DUPLICATE QC DATA

Analyte	Seq/ Batch	Source Result	Spike Level	Units	MDL	MRL	Result	Dup Result	% REC	Dup %REC	% REC Limits	RPD	RPD Limit	Q
Semivolatile Organics by GC/MS														
N-Nitrosodiphenylamine	5120968		100	ug/L	N/A	10.0	79.0		79		30-120			
N-Nitrosodi-n-propylamine	5120968		100	ug/L	N/A	10.0	75.9		76		40-100			
Phenanthrene	5120968		100	ug/L	N/A	10.0	79.2		79		40-125			
Pyrene	5120968		100	ug/L	N/A	10.0	87.3		87		40-125			
4-Chloro-3-methylphenol	5120968		100	ug/L	N/A	10.0	74.8		75		40-115			
2-Chlorophenol	5120968		100	ug/L	N/A	10.0	67.3		67		35-100			
2-Nitrophenol	5120968		100	ug/L	N/A	10.0	76.1		76		35-110			
4-Nitrophenol	5120968		100	ug/L	N/A	10.0	33.1		33		10-70			
Pentachlorophenol	5120968		100	ug/L	N/A	10.0	79.9		80		30-125			
Phenol	5120968		100	ug/L	N/A	10.0	28.4		28		10-60			
Surrogate: Nitrobenzene-d5	*5120968*			ug/L					*76*		*35-110*			
Surrogate: 2-Fluorobiphenyl	*5120968*			ug/L					*74*		*30-120*			
Surrogate: Terphenyl-d14	*5120968*			ug/L					*90*		*35-130*			
Surrogate: Phenol-d6	*5120968*			ug/L					*29*		*10-60*			
Surrogate: 2-Fluorophenol	*5120968*			ug/L					*45*		*10-75*			
Surrogate: 2,4,6-Tribromophenol	*5120968*			ug/L					*88*		*45-140*			

TestAmerica
ANALYTICAL TESTING CORPORATION

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FANSTEEL/WELLMAN CORP.
1746 Commerce Road
Creston, IA 50801
Joe Haller

Work Order: COL1216
Project: Landfill Leachate Permit Renewal
Project Number: Landfill Leachate Permit Renewal

Received: 12/28/05
Reported: 01/31/06 13:48

MATRIX SPIKE/MATRIX SPIKE DUPLICATE QC DATA

Analyte	Seq/ Batch	Source Result	Spike Level	Units	MDL	MRL	Result	Dup Result	% REC	Dup %REC	% REC Limits	RPD	RPD Limit	Q
General Chemistry Parameters														
QC Source Sample: COL1216-01														
Nitrate as N	5120914	0.553	2.00	mg/L	N/A	1.00	2.12	2.21	78	83	75-125	4	20	
QC Source Sample: COL1204-02														
Total Kjeldahl Nitrogen	5120937	9.05	5.00	mg/L	N/A	1.25	15.9	15.4	137	127	90-110	3	15	M1
QC Source Sample: COL0984-02														
Alkalinity, Total (CaCO3)	5120954	945	114	mg/L	N/A	N/A	1070	1080	110	118	80-125	1	10	
QC Source Sample: COL1051-04														
Chemical Oxygen Demand	5120970	229	50.0	mg/L	N/A	25.0	271	277	84	96	75-125	2	20	
QC Source Sample: COL1125-09														
Oil & Grease	5120982	0.860	42.1	mg/L	N/A	N/A	38.0		88		78-114			
QC Source Sample: COL1192-02														
Ammonia as N	5120985	1.29	3.33	mg/L	N/A	0.500	4.88	5.19	108	117	75-125	6	20	
QC Source Sample: COL1194-01														
Phosphorus, Total (as P)	6010010	6.86	2.00	mg/L	N/A	0.200	9.71	9.68	142	141	90-110	0	15	M1
QC Source Sample: COL1058-02														
Chloride	6010017	15.8	25.0	mg/L	N/A	5.00	39.7	40.0	96	97	90-110	1	10	
QC Source Sample: COL0986-01														
Total Organic Carbon	6010057	27.1	20.0	mg/L	N/A	4.00	46.0	47.5	94	102	75-125	3	20	ET
QC Source Sample: COL1216-01														
Sulfate	6010255	1070	333	mg/L	N/A	333	1290	1290	66	66	75-125	0	20	M1
QC Source Sample: COL1216-01														
Fluoride	6010305	110	25.0	mg/L	N/A	14.5	138	132	112	88	75-125	4	15	
Total Metals by EPA 200 Series Methods														
QC Source Sample: COL1214-02														
Aluminum	5120994	0.197	2.00	mg/L	N/A	0.100	2.12	2.14	96	97	75-125	1	10	
Arsenic	5120994	0.0837	2.00	mg/L	N/A	0.0800	2.07	2.03	99	97	85-120	2	10	
Barium	5120994	0.325	1.00	mg/L	N/A	0.0100	1.25	1.26	92	94	75-120	1	10	
Cadmium	5120994	<0.020	1.00	mg/L	N/A	0.0200	0.948	0.950	95	95	80-115	0	10	
Chromium	5120994	<0.020	1.00	mg/L	N/A	0.0200	0.950	0.960	95	96	80-115	1	10	
Copper	5120994	0.0331	2.00	mg/L	N/A	0.0200	1.89	1.92	93	94	85-115	2	10	
Lead	5120994	<0.10	2.00	mg/L	N/A	0.100	1.93	1.97	96	98	80-115	2	10	
Manganese	5120994	0.0380	1.00	mg/L	N/A	0.0100	0.973	0.981	94	94	75-125	1	10	
Nickel	5120994	0.0268	2.00	mg/L	N/A	0.0500	1.85	1.86	91	92	80-110	1	10	
Potassium	5120994	2.85	4.00	mg/L	N/A	1.00	6.82	6.89	99	101	75-125	1	10	
Selenium	5120994	<0.15	4.00	mg/L	N/A	0.150	3.93	3.93	98	98	80-120	0	10	
Silver	5120994	<0.020	1.00	mg/L	N/A	0.0200	0.974	0.983	97	98	75-125	1	20	
Zinc	5120994	0.0164	1.00	mg/L	N/A	0.0200	0.964	0.971	95	95	75-125	1	20	
Magnesium	5120994	36.3	2.00	mg/L	N/A	1.00	38.3	38.5	100	110	80-115	1	10	
QC Source Sample: COL0831-01														
Mercury	6010059	0.0000212	0.00167	mg/L	N/A	0.000200	0.00179	0.00181	106	107	75-125	1	10	
Volatile Organic Compounds														
QC Source Sample: COL1216-01														
Acetone	6010055	6.15	20.0	ug/L	N/A	N/A	21.7	20.0	78	69	20-115	8	30	
Benzene	6010055	0.610	20.0	ug/L	N/A	N/A	17.7	17.2	85	83	60-135	3	15	
Bromomethane	6010055	<4.00	20.0	ug/L	N/A	N/A	21.8	19.8	109	99	30-125	10	35	
Carbon Tetrachloride	6010055	<2.00	20.0	ug/L	N/A	N/A	15.5	14.7	78	74	25-120	5	30	
Chlorobenzene	6010055	<1.00	20.0	ug/L	N/A	N/A	19.9	18.8	100	94	50-140	6	15	
Chloroform	6010055	<1.00	20.0	ug/L	N/A	N/A	17.4	17.0	87	85	45-140	2	30	
Bromochloromethane	6010055	<5.00	20.0	ug/L	N/A	N/A	22.5	21.6	112	108	45-140	4	35	
1,2,3-Trichloropropane	6010055	<1.00	20.0	ug/L	N/A	N/A	22.2	20.8	111	104	55-150	7	15	

TestAmerica Analytical - Cedar Falls
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Organics Manager

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704 Enterprise Drive Cedar Falls, IA 50613 * 800-750-2401 * Fax 319-277-2425

FANSTEEL/WELLMAN CORP.
1746 Commerce Road
Creston, IA 50801
Joe Haller

Work Order: COL1216
Project: Landfill Leachate Permit Renewal
Project Number: Landfill Leachate Permit Renewal

Received: 12/28/05
Reported: 01/31/06 13:48

MATRIX SPIKE/MATRIX SPIKE DUPLICATE QC DATA

Analyte	Seq/ Batch	Source Result	Spike Level	Units	MDL	MRL	Result	Dup Result	% REC	Dup %REC	% REC Limits	RPD	RPD Limit	Q
Volatile Organic Compounds														
QC Source Sample: COL1216-01														
1,4-Dichlorobenzene	6010055	<1.00	20.0	ug/L	N/A	N/A	20.5	19.4	102	97	45-140	6	15	
1,2-Dichloroethane	6010055	<1.00	20.0	ug/L	N/A	N/A	22.0	21.3	110	106	55-135	3	10	
1,1-Dichloroethene	6010055	0.460	20.0	ug/L	N/A	N/A	16.0	15.8	78	77	45-135	1	20	
Ethylbenzene	6010055	0.280	20.0	ug/L	N/A	N/A	16.4	15.4	81	76	50-135	6	15	
Methylene Chloride	6010055	<5.00	20.0	ug/L	N/A	N/A	18.9	18.6	94	93	60-140	2	15	
Tetrachloroethene	6010055	<1.00	20.0	ug/L	N/A	N/A	17.4	15.6	87	78	50-135	11	35	
Trichloroethene	6010055	<1.00	20.0	ug/L	N/A	N/A	15.9	15.0	80	75	50-130	6	25	
1,1,2-Trichloroethane	6010055	<1.00	20.0	ug/L	N/A	N/A	20.6	20.4	103	102	50-145	1	35	
1,1,1-Trichloroethane	6010055	<1.00	20.0	ug/L	N/A	N/A	15.5	14.8	78	74	40-135	5	10	
Vinyl chloride	6010055	5.06	20.0	ug/L	N/A	N/A	16.9	16.3	59	56	40-135	4	15	
Xylenes, total	6010055	2.53	60.0	ug/L	N/A	N/A	59.8	56.4	95	90	45-140	6	30	
Surrogate: Dibromofluoromethane	*6010055*			ug/L					*105*	*107*	*70-130*			
Surrogate: Toluene-d8	*6010055*			ug/L					*108*	*104*	*70-130*			
Surrogate: 4-Bromofluorobenzene	*6010055*			ug/L					*99*	*97*	*70-130*			
Semivolatile Organics by GC/MS														
QC Source Sample: COL1191-04														
Acenaphthene	5120968	<10.0	222	ug/L	N/A	22.2	122	152	55	68	10-90	22	35	
Acenaphthylene	5120968	<10.0	222	ug/L	N/A	22.2	116	143	52	64	10-90	21	35	
Anthracene	5120968	<10.0	222	ug/L	N/A	22.2	129	158	58	71	10-95	20	35	
Benzo (a) anthracene	5120968	<10.0	222	ug/L	N/A	22.2	134	167	60	75	10-95	22	35	
Benzo (b) fluoranthene	5120968	<10.0	222	ug/L	N/A	22.2	133	166	60	75	10-95	22	35	
Benzo (k) fluoranthene	5120968	<10.0	222	ug/L	N/A	22.2	130	162	59	73	10-95	22	35	
Benzo (a) pyrene	5120968	<10.0	222	ug/L	N/A	22.2	133	163	60	73	10-95	20	35	
Benzo (g,h,i) perylene	5120968	<10.0	222	ug/L	N/A	22.2	123	153	55	69	10-95	22	35	
Chrysene	5120968	<10.0	222	ug/L	N/A	22.2	133	165	60	74	10-85	21	35	
Dibenzo (a,h) anthracene	5120968	<10.0	222	ug/L	N/A	22.2	130	162	59	73	10-100	22	35	
1,4-Dichlorobenzene	5120968	<10.0	222	ug/L	N/A	22.2	109	144	49	65	10-85	28	35	
2,4-Dinitrotoluene	5120968	<10.0	222	ug/L	N/A	22.2	139	174	63	78	10-95	22	35	
Fluoranthene	5120968	<10.0	222	ug/L	N/A	22.2	131	159	59	72	10-95	19	35	
Fluorene	5120968	<10.0	222	ug/L	N/A	22.2	128	159	58	72	10-95	22	35	
Indeno (1,2,3-cd) pyrene	5120968	<10.0	222	ug/L	N/A	22.2	129	158	58	71	10-100	20	35	
2-Methylnaphthalene	5120968	<10.0	222	ug/L	N/A	22.2	118	153	53	69	10-90	26	35	
Naphthalene	5120968	<10.0	222	ug/L	N/A	22.2	112	145	50	65	10-85	26	35	
N-Nitrosodiphenylamine	5120968	<10.0	222	ug/L	N/A	22.2	123	160	55	72	10-95	26	35	
N-Nitrosodi-n-propylamine	5120968	<10.0	222	ug/L	N/A	22.2	135	172	61	77	10-90	24	35	
Phenanthrene	5120968	<10.0	222	ug/L	N/A	22.2	128	157	58	71	10-95	20	35	
Pyrene	5120968	<10.0	222	ug/L	N/A	22.2	140	176	63	79	10-95	23	35	
4-Chloro-3-methylphenol	5120968	<10.0	222	ug/L	N/A	22.2	127	165	57	74	10-100	26	35	
2-Chlorophenol	5120968	<10.0	222	ug/L	N/A	22.2	112	144	50	65	10-90	25	35	
2-Nitrophenol	5120968	<10.0	222	ug/L	N/A	22.2	127	160	57	72	10-95	23	35	
4-Nitrophenol	5120968	<10.0	222	ug/L	N/A	22.2	60.4	78.7	27	35	10-75	26	35	
Pentachlorophenol	5120968	<10.0	222	ug/L	N/A	22.2	129	186	58	84	10-105	36	35	
Phenol	5120968	<10.0	222	ug/L	N/A	22.2	47.5	62.8	21	28	10-60	28	35	
Surrogate: Nitrobenzene-d5	*5120968*			ug/L					*57*	*73*	*35-110*			
Surrogate: 2-Fluorobiphenyl	*5120968*			ug/L					*54*	*67*	*30-120*			

TestAmerica Analytical - Cedar Falls
Derrick Klinkenberg
Organics Manager

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FANSTEEL/WELLMAN CORP.	Work Order:	COL1216	Received:	12/28/05
1746 Commerce Road	Project:	Landfill Leachate Permit Renewal	Reported:	01/31/06 13:48
Creston, IA 50801	Project Number:	Landfill Leachate Permit Renewal		
Joe Haller				

MATRIX SPIKE/MATRIX SPIKE DUPLICATE QC DATA

Analyte	Seq/ Batch	Source Result	Spike Level	Units	MDL	MRL	Result	Dup Result	% REC	Dup %REC	% REC Limits	RPD	RPD Limit	Q
Semivolatile Organics by GC/MS														
QC Source Sample: COL1191-04														
Surrogate: Terphenyl-d14	*5120968*			ug/L					*64*	*64*	*35-130*			
Surrogate: Phenol-d6	*5120968*			ug/L					*22*	*30*	*10-60*			
Surrogate: 2-Fluorophenol	*5120968*			ug/L					*33*	*44*	*10-75*			
Surrogate: 2,4,6-Tribromophenol	*5120968*			ug/L					*67*	*85*	*45-140*			

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Project Number:	Landfill Leachate Permit Renewal		

CERTIFICATION SUMMARY

TestAmerica Analytical - Cedar Falls

Method	Matrix	Nelac	Iowa
ASTM D516-90	Water - NonPotable	X	X
EPA 150.1	Water - NonPotable	X	X
EPA 160.4	Water - NonPotable	X	X
EPA 1664	Water - NonPotable	X	X
EPA 200.7	Water - NonPotable	X	X
EPA 245.2	Water - NonPotable	X	X
EPA 351.2	Water - NonPotable	X	X
EPA 353.3	Water - NonPotable	X	X
EPA 365.1	Water - NonPotable	X	X
EPA 608	Water - NonPotable	X	X
EPA 624	Water - NonPotable	X	X
EPA 625	Water - NonPotable	X	X
SM 2320B	Water - NonPotable	X	X
SM 2540B	Water - NonPotable	X	X
SM 4500Cl E	Water - NonPotable	X	X
SM 4500F BC	Water - NonPotable	X	X
SM 4500NH3 B,E	Water - NonPotable	X	X
SM 5210B	Water - NonPotable	X	X
SM 5220D	Water - NonPotable	X	X
SM 5310C	Water - NonPotable	X	X
SM2320B	Water - NonPotable	X	X
SM2540C	Water - NonPotable	X	X
SW 8151	Water - NonPotable		
SW	Water - NonPotable		
USGS I-3765-85	Water - NonPotable	X	X

Subcontracted Laboratories

UHL - Iowa City

102 Oakdale Campus, #h101 OH - Iowa City, IA 52242-5002

Method Performed: 608 Pesticides
Samples: COL1216-01

Method Performed: 8151 Herbicides
Samples: COL1216-01

Any abnormalities or departures from sample acceptance policy shall be documented on the 'Sample Receipt and Termperature Log Form' and 'Sample Non-conformance Form' (if applicable) included with this report.

For information concerning certifications of this facility or another TestAmerica facility, please visit our website at www.TestAmericaInc.com

Samples collected by TestAmerica Field Services personnel are noted on the Chain of Custody (COC) and are sampled in accordance with TA-CF SOP CF09-01.

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Organics Manager

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FANSTEEL/WELLMAN CORP.	Work Order:	COL1216	Received:	12/28/05
1746 Commerce Road	Project:	Landfill Leachate Permit Renewal	Reported:	01/31/06 13:48
Creston, IA 50801	Project Number:	Landfill Leachate Permit Renewal		
Joe Haller				

DATA QUALIFIERS AND DEFINITIONS

C	Calibration Verification recovery was above the method control limit for this analyte. Analyte not detected, data not impacted.
CIN	The % RSD for this compound was above 15%. The average % RSD for all compounds in the calibration met the 15% criteria specified in EPA methods 8260B/8270C.
ET	Matrix interference in sample is causing an endpoint timeout.
H3	Sample was received and analyzed past holding time.
L	Laboratory Control Sample and/or Laboratory Control Sample Duplicate recovery was above the control limits. Analyte not detected, data not impacted.
M1	The MS and/or MSD were outside control limits. See Blank Spike (LCS).
R	Duplicate RPD exceeded the laboratory control limit.

ADDITIONAL COMMENTS

TestAmerica
ANALYTICAL TESTING CORPORATION

Cedar Falls Division
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Cedar Falls, IA 50613

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To assist us in using the proper analytical methods, is this work being conducted for regulatory purposes?
Compliance Monitoring ______

Client Name: Fansteel Wellman Dynamics Client #: ______
Address: 1746 Commerce Road
City/State/Zip Code: Creston, IA 50801
Project Manager: Joe Haller
Telephone Number: 641-782-8521 ext 206 Fax: 641-782-4844
Sampler Name: (Print Name) Joe Haller
Sampler Signature: Joe Haller
Email Address: jhaller@weldyn.net

Project Name: Landfill Leachate Permit Renewal
Project #: ______
Site/Location ID: ______ State: ______
Report To: ______
Invoice To: ______
Quote #: ______ PO#: 72933

TAT
___ Standard
___ Rush (surcharges may apply)

Date Needed: ______

Fax Results: Y N

Email Results: Y N

QC Deliverables
___ None
___ Level 2 (Batch QC)
___ Level 3
___ Level 4
Other: ______

SAMPLE ID	Date Sampled	Time Sampled	G = Grab, C = Composite	Field Filtered	Matrix: SL - Sludge DW - Drinking Water GW - Groundwater S - Soil/Solid WW - Wastewater Specify Other	Preservation & # of Containers: HNO_3	HCl	NaOH	H_2SO_4	Methanol	None	Other (Specify)	Analyze For: Oil & Grease	TOC	COD, TKN, PO4	Chloride, Fluoride, NO3, pH, TDS, TSS, TVS	Sulfate	Total Metals	BNA, Pests, Herbs	VOC's			REMARKS
12/27/05 Bottles #1,2,3,10	12/27	9:20	G		GW				X				X	X	X								
12/27/05 Bottles #4,5,6,7,8,9	12/27	9:20	G		GW						X					X	X		X				
12/27/05 #11	12/27	9:20	G		GW	X												X					
12/27/05 Bottles 12,13,14	12/27	9:20	G		GW		X													X			

Special Instructions: See Quote ID: Landfill Leachate Permit Renewal, for parameters to be tested or call if there is questions JH
* Include all quote parameters.

LABORATORY COMMENTS:

Relinquished By	Date	Time	Received By	Date	Time
Joe Haller	12/27	3PM	[signature]	12/28/05	8:40

Page ______ of ______

TestAmerica
ANALYTICAL TESTING CORPORATION

704 Enterprise Drive • Cedar Falls, IA 50613 • 800-750-2401 • 319-277-2425 Fax

Sample Receipt and Temperature Log Form

Client: Fansteel Wellman Project: Landfill Leachate Permit Renewal

City: ____________________

Date: 12-28-05 Receiver's Initials JPH Time (Delivered): 8:40

Temperature Record

Cooler ID# (If Applicable) TACF563

2 °C / **On Ice**

[X] Temp Blank

[ ] Temperature out of compliance

Custody seals present?
[X] Yes

Custody seals intact?
[X] Yes [ ] No

[ ] Non-Conformance report started

Thermometer:

[X] IR – 905085 "A"
[ ] IR – 809065 "B"
[ ] CF07-03-T2
[ ] 22126775

Courier:

[ ] Airborne
[X] UPS
[ ] Velocity
[ ] FedEx
[ ] DHL
[ ] US Postal
[ ] Speedy
[ ] TA Courier
[ ] TA Field Svs
[ ] Client
[ ] Other

Exceptions Noted

[ ] Sample(s) not received in a cooler.

[ ] Samples(s) received same day of sampling.

[ ] Evidence of a chilling process

[ ] Temperature not taken: ____________________

Log-In by:
CW MF EM
OT__________

*Refer to SOP CF01-01 for Temperature Criteria

C:\QA Folder\QA Forms & Log Book pgs\Cooler Receipt rev7.doc